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'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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ELEMENTARY LESSONS IN AGRICULTURE.

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XIV.

THE DISEASES OF FIELD CROPS—(*Continued*).

BEFORE leaving the cereals and other grasses, there remains to mention another very curious fungus, which owes its chief importance to the fact that, apart from its damaging the plants on which it grows, it is a very virulent poison to animals that eat the plant infested with it. This is the *ergot*, which is most commonly associated with rye, but which is not at all uncommon in other grasses. Indeed, more than twenty species have been stated to be infested with it, including most of the ordinary grasses of pasture, besides the cereal crops. When eaten by an animal, especially in the fresh state, it has a powerful effect in exciting muscular contractions of certain parts, and often it sets up serious gangrenous diseases, which are curiously associated with very slight fever, inflammation, or pain. The absence of pain is, however, not a constant feature of its action; sometimes this symptom is very marked. The ergot is a fungus which has a very curious life-history. It can first be detected as a filamentous mycelium of somewhat sweet taste and very viscid character, which attaches itself to the surface of the young ovary of the grass on which it is about to develope. Gradually the ovary becomes almost entirely replaced by a soft white mass of hyphæ, on which are borne a great number of spores or conidia. This mycelium is known as a *sphacelium*, and the spores it bears can reproduce it abundantly. After a time the sphacelium becomes very compact and hard, the lower portion becoming changed first. The result of the gradual change is the production of a hard black body, which protrudes from the ear, being two or three times as long as the grain which it has replaced. This hard black body is the ergot proper, and from its hardness is often spoken of as a *sclerotium*. Several of these can be seen on a single ear, but the remainder of the ear will produce quite normal grains. These ergot bodies, or sclerotia, are longitudinally furrowed, and often cracked or split. They are somewhat aromatic, and contain a viscid, yellowish oil. They remain in this state all the winter, and are consequently often found in a sample of the grain. If one of them fall upon damp ground, it will germinate in the early summer, and from it will spring a number of stalked bodies crowned with purple heads, which are rough or covered with small knobs. One of these cut vertically will show embedded over its surface and extending about one-sixth of the depth of the head, a number of oval pits filled with the reproductive bodies. These latter are elongated spores of somewhat wavy shape, eight of them being enclosed in each of a number of long, narrow pitchers, or *asci*. The pits are known as *perithecia*, and in each of them may be found quite a number of the asci. The spores are ejected from the perithecia usually in June, and emerge with some violence. Often the asci, too, are ejected. A spore falling on the rye flowers will then germinate and produce a new sphacelium.

One of the most dangerous features of the ergot pest is that it is extremely frequent in the common rye grass, which is almost always a constituent of pasture. It thus comes in the way of cattle, and, being eaten by them, great loss is often caused to the farmer.

It is difficult to suggest a remedy for ergot. As with most of the fungoid pests, good cultivation of the soil is the best preventive measure. It is most abundant where the drainage is defective. A good deal can be done to remove it by cutting off the flowering portions of the infested grasses, though this, of course, is unavailable when the plant on which it is flourishing is one of the cereals. The ergot of rye is much larger than the grain, so that it can be sifted out; but the ergot attacking wheat is not much larger than the wheat grain, so that hand-picking is the only treatment possible.

A somewhat similar fungus is often found on some of the pasture grasses, particularly the *Festucas*. The growth appears in the autumn, and may be detected until the following January, or even later. In its early stages it is much like the sphacelium of ergot, the mycelium being viscid and tending to glue together different parts of the grass. It is often brilliantly coloured

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with different shades of pink or red, though sometimes it is said to be pallid. This stage of the pest is characterised also by the production of conida or spores. It seems later to show much the same changes as ergot does, but instead of the spores in the asci being simple cells, each produces a long chain, consisting of perhaps a hundred cells, which all become detached when the perithecium discharges its contents.

Perhaps one of the most deadly diseases known in the vegetable kingdom is the potato disease, which often produces such serious trouble to the agriculturists of Ireland. There are several pests which attack this crop, but the most destructive is that known as *Peronospora*, or *Phytophthora infestans*. This generally appears quite late in the season, when the plant is in full leaf, say in July or August. The first appearance that is noticeable is a peculiar bloom on the leaves, and dark putrid spots may also be detected at about the same time. Usually the lower leaves and the stems are first affected, the disease spreading thence downwards. The black putrid blotches by-and-by are found to reach the tubers, causing them to rot. Curious atmospheric conditions are generally found to precede the outbreak of the pest, close, humid weather, with morning and evening mists, being as a rule observed. In the blotches we have the mycelium of the fungus, which develops in the internal tissue of the plant, sending up hyphæ through the stomata of the leaves to bear certain of the reproductive organs. The development of the pest is associated with a very offensive smell, resulting from the putrefaction. A very curious feature of its life-history is the apparent suddenness of its appearance, though this is probably more apparent than real, as the pest may remain in the potato-plant for some time previous to its general recognition. When it does burst out, however, its course is extremely rapid, whole fields of plants being reduced from an apparently healthy condition to that of a decaying mass of vegetation in a few hours.

The fungus is of rather a higher order than any we have hitherto noticed. The mycelium can be observed best in the leaves, a transverse section of one of them showing it as a mass of ramifying threads or hyphæ, infecting chiefly the lower surface. All the cells with which the mycelium comes into contact become discoloured, and their contents begin to putrify. The mycelium itself is made up of very fine threads, which are colourless and transparent. After infecting the internal cells of the leaves, destroying the chlorophyll and so discolouring the leaves, the fungus sends up branches, which make their way through the stomata or pores in the epidermis. As it is these through which, as we have seen, the watery vapour mainly escapes, the effect is to hinder transpiration, and so to help in the putrefactive changes. The branches just alluded to, in emerging into the air, put out further branches, each of which ends in a spore or conidium, enormous numbers of these being thus produced. When these drop off on to any moist surface, instead of reproducing the mycelium, each one produces in its interior several masses of protoplasm which are set free by the rupture of the wall of the spore. Each separate piece, actively living, soon becomes furnished with two thread-like appendages of its substance, known as *cilia*, and is then capable of active movement, swimming about in the film of water or moisture which covers the leaf. After a time these *zoospores*, as they are called, come to rest, lose their cilia, and after a short time give rise to a thread which proves to be the beginning of a new mycelium.

The fungus has, however, another and more complicated mode of reproduction, on account of which it is ranked rather high up in the scale of these organisms. In the interior of the leaf certain of the filaments or hyphæ bear, usually at their apices, globular swellings of small size. These have a well-defined cell-wall, and usually contain somewhat granular protoplasm; other filaments growing near the first also bear somewhat club-shaped bodies of more elongated form and smaller size. We have here the production of bodies endowed with sexuality, the larger rounded ones being the female organs of the fungus, and the small elongated ones the males. In the course of growth the males, or *antheridia*, come into contact with the females, or *oogonia*, and very soon protrude a short tube which penetrates the oogonium wall. Through this tube the contents of the antheridium pass over bodily into the oorgonium, and after a certain churning process, ultimately the two masses of protoplasm fuse together. The fusion effected, the newly-formed body secretes a new cell-wall round it, and becomes what is known as an *oospore*, which is liberated from the fungus, and later on develops the mycelium again.

Not only are these oospores, or resting spores, formed in the leaves of the potato plant, but they occur, and in great numbers too, in the old tuber from which the plant has sprung. They may also be easily discovered in the old diseased or damaged tubers left to rot after the disease has done its work.

Much controversy, naturally, has taken place as to the best curative or preventive treatment of the disease. It seems to be well ascertained that cure after the fungus has once become developed is quite impossible. Prevention or palliation may be secured with care and skill on the part of the cultivator. To prevent the recurrence of the disease when it has once made its appearance, the only way is to destroy the material which has undergone infection. Burning all the refuse is the most effectual plan; when this is impossible, deep burial will generally succeed. With the object of prevention the greatest care should be taken to select such varieties of potato as are hardy and have not shown any traces of the fungus. They should be grown in soil that is well drained, and only mineral manure should be used in the cultivation. Storage of the seed potatoes should be confined to dry, airy places, and a certain amount of light should be allowed access to them. If they are stored in damp, dark places, the conditions are favourable to fungoid growths. It is well to plant the 'sets' at least three or four inches below the surface of the soil, though this can be carried too far, as too great a depth interferes injuriously with the development of the plant.

Another disease which sometimes attacks potatoes is caused by another fungus, belonging to the group of the *Pezizas*. This produces a thick felt of white mycelium, which covers the plant and rapidly reduces the whole of the stems and leaves to a dry tindery condition, exhausting all the natural moisture which they nominally contain. The result of this destruction of the vegetative organs prevents the formation or growth of the tubers. There is in this disease an absence of the offensive putrefaction which is so marked a symptom of the Phytophthora.

This fungus produces its reproductive bodies in a different way from the former one. Impacted in the

dense felting of the mycelium are found thousands of small black hard bodies of very varying size. They very much resemble the sclerotia of ergot, and are known by the same name. These can remain for a long time in a condition of vitality, and reproduce the mycelium when conditions become favourable. They give rise to long slender stems, each of which bears at its apex a club-shaped or somewhat flattened head, which is sometimes half an inch in diameter. In structure these heads resemble the heads found in the case of the ergot, and produce enormous numbers of asci, each containing eight spores. Burning all infected material seems at present to be the only successful way of dealing with the disease.

Potatoes are also attacked by a disease much like the *Fusisporium*, described last month as attacking wheat, and a kind of smut is also not uncommonly found. The life history of this pest is much the same as that described as attacking cereals. It grows under the outer skin of the tuber, and forms a thin dark green stratum, which often extends over the greater part of the external surface.

Besides these fungoid pests, potatoes are often found to have a kind of brownish scab on their surface, or the latter may become cracked and unsound. This is probably due to a mechanical cause. Its effect is to spoil the flavour of the tuber, as the contact of the exposed inner portions to the soil produces a very disagreeable earthy taste. The disorder is generally produced by irritating substances in the soil.

Of the diseases affecting leguminous plants, the one most commonly met with is that known as clover sickness. It is impossible, however carefully manure is applied year by year to the soil, to cultivate clover for a long series of years. After a while the crop fails, and the ground is said to be *clover-sick*. Various reasons have been assigned for this fact; some agriculturists holding the opinion that it is due to a deficiency of potash salts in the soil and subsoil. The Rothampstead experiments, already frequently alluded to, seem to negative this view, and at present no satisfactory explanation is forthcoming. Other crops, such as the cereals, can be cultivated for very many years in succession, if only the proper manure be continually supplied to them. Clover forms a conspicuous exception, however. The disorder has, by others been attributed to various forms of fungoid growth, but the evidence that it is so caused is insufficient.

The fungus parasites of all the leguminous crops are but few in number, and include various forms of mildew. One conspicuous one, attacking clover and lucerne chiefly, is a Peronospora, allied to the Phytophthora of the potato. Its course is much like that of the potato disease, inducing putrefactive changes in the living tissues.

A pest of a different order and of a much higher type is the Dodder, a plant related to the Convolvulus. The plant is a flowering-plant which has abandoned its proper habit of life, and, instead of drawing its food supplies from the soil, it attaches itself to some unfortunate host-plant—in this case the clover—and twines its own stem around the stem and leaves of its host. It then puts out roots which penetrate the tissue of the plant on which it is preying, and imbibe the natural juices of the latter. The dodder, obtaining its nutritive substances so easily, puts forth no leaves, but bears flowers in little compact heads or clusters. The clover dodder does not as a rule set seed, but some of its relatives bear fruit and seed in the way of an ordinary flowering plant. The clover is usually attacked by the pest while it is very young, and as it grows the dodder grows with it, destroying the plant. As the clover dies, the dodder leaves it for other plants close by, and so patches of dead clover many feet in diameter may be seen in an infected field.

Root crops also may be attacked by many fungi, much resembling some of those we have already described. Turnips are sometimes found to be infested with a mildew known as an *oidium*, something like in external appearance a peronospora. The resemblance is, however, only superficial, as the reproductive bodies are dissimilar. It produces a white mouldy appearance on the leaves. This fungus has a mycelium which only affects the superficial part of the leaf, and does not, like a peronospora, invade the internal cells. It chiefly injures the plant by interfering with its transpiration, or giving off of watery vapour, and so causing a failure of nutrition. The result is the production of very poor roots.

A true putrefactive mildew, or peronospora, also attacks the turnip, running the same general course as in the case of the fungus of the potato, with which it has much in common. It differs somewhat from the latter, in that it does not give rise to zoospores.

Cruciferous plants, such as the cabbage, are often infested with a fungus known as white rust. The leaves and stems are swollen, distorted, and spotted with white streaks and blotches, sometimes very regularly disposed. The name of this fungus is *Cystopus candidus*. The life history which it displays recalls very much the life history of Peronospora, to which it is allied. Generally the infection is due to the zoospores produced in its development germinating on the cotyledons or seed leaves of the young cabbage plant.

Club-root is another disease attacking both root crops and cruciferous plants. This is due to a curious fungus belonging to the group of the Myxomycetes, which have the peculiarity of not possessing cell walls. Their protoplasm remains free and is capable of slow movement, so that the pest can creep about in the substratum on which it grows. When a plant is attacked with this disease the root shows on its smaller branches a number of spindle-shaped swellings, which, when cut across, are found to be filled with a slimy plasma belonging to the fungus.

A Peronospora also is found infecting lettuces, causing patches of decomposition on the leaves, attacking first those on the outside, but gradually spreading till it affects the heart. This is very likely to be developed where the plants are sown too thickly, for warmth and moisture are very favourable to its growth.

To recapitulate: we have seen that—

1. Rye and other grasses are liable to be attacked by the fungus known as ergot, which developes a very poisonous principle, often inducing grave disorder and disease in animals eating it.

2. Potatoes are liable to the attacks of several fungi, of which the Phytophthora is the most deadly.

3. They can also be affected prejudicially by certain conditions of the soil, mechanical injury resulting therefrom.

4. Leguminous crops, besides being subject to the attack of similar fungoid disorders, are often attacked by a flowering parasite—the dodder.

5. The root crops, cruciferous plants, onions and lettuces have all their particular enemies, chiefly fungi, which are, in general, close relatives of those described as attacking other crops.

6. In all these cases cure of the disease is quite impossible when it is once established. By careful cultivation and precaution the danger of infection can be very much lessened, one of the chief points to notice being the destruction of all infected material.

(*To be continued.*)

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TACT

IN THE BUSINESS OF SCHOOL-KEEPING.

BY RICHARD BALCHIN.

'TACT in the management of Inspectors!' Fancy that! The presumption of the thing! As if Inspectors *could* be managed; or *required* to be managed! And if so, who is to do it? Bear in mind, we are now speaking of Her Majesty's Inspectors! Real Government Inspectors! Clergymen of the Established Church! Not Board Inspectors, instructors, or organizers. Oh no! Something more than that! Gentlemen upon whose opinion, and upon whose ability to form an opinion, hangs the fate of many hundreds of people! It seems monstrous to talk of managing such as those. Only in a rank democratic age, steeped through and through with a levelling socialism, would such an idea be for one moment entertained! And yet, surely *some* amount of prudent consideration is necessary in our dealings with those important officials. I have known many instances of a deplorable want of tact here. An assistant knows perfectly well that a certain Inspector is 'strong' upon object-lessons and 'objects.' Yet he gives his specimen lesson without a single 'object' before the children! I go with that Inspector into another class-room and find the table literally covered with blocks of iron ore, clay-band, black-band, roasted ore, pig-iron, etc. 'Ah, how very interesting all this is! The boys here have something to look at and to think about.' 'You have a valuable teacher here.' Other similar remarks follow, all of which are encouraging and of considerable weight in the balance of evidence as to the official estimate of the teacher's ability.

My first Inspector was Matthew Arnold; my last the Rev. C. D. Du Port; while the intervening series has included among others such honoured names as Laurie, Morell, Sharpe, and Fitch. My experience has therefore been a singularly happy one. With perhaps one exception, all these gentlemen have been of conspicuous ability and culture, and of extraordinary zeal and enthusiasm in the work of elementary education, while their estimate and criticism I have always felt to be just. During the whole of my forty years' work it has been my good fortune to meet with one only, one single specimen of a man who ought never to have been appointed to the position of Censor of the work of Education. Cold and soulless, without a spark of sympathy, void of any dram of mercy, utterly ignorant of child-life, and altogether outside of its little world of delights and strivings, fears and fancies, longings and honest endeavours.

First we will consider the type with which, fortunately, I have the greatest acquaintance:—

THE INSPECTOR WHO IS CONSPICUOUSLY A CHRISTIAN GENTLEMAN.

Such a one enters the school beaming with benevolent intentions. Genial remarks and hearty handshakings at once establish mutual trust, and betoken a pleasant day for all concerned; provided always, that the work throughout the year has been honest and effective. He goes with you into a class-room, turns a happy, smiling face upon the boys, and wishes them 'Good morning.' The boys 'catch the sunshine,' and return the greeting with freedom and unstrained child-nature. How truly responsive the young mind is to a sympathetic presence!

And now, as the 'crimson-tipped flower' opens its florets to the sun, so do the boys open wide their minds to the examiner, who looks right through their rosy faces into their little mind-worlds, and sees 'all that therein is,' and notes also *how* it all entered there; in other words, he becomes thoroughly and accurately acquainted with the mental training which these boys have had in the past year, assessing the teacher's ability accordingly.

In the presence of such an Inspector, I would say let everything be quite open and free. The teacher may with perfect confidence submit the estimate of his work to the judgment of this gentleman. Above all, avoid all bungling excuses for any little weakness, which is almost certain to be discovered in a large school. I remember an occasion on which, some years ago, Dr. Fitch was questioning a class on geography. He asked a simple question, which only a very few of the boys could answer. The examiner would have passed on to other points, but was interrupted by the class-teacher's remark that '*that* is not in the book.' 'What book?' asked the doctor. 'Our Geographical Reader,' was the reply. 'Very well, then,' said the Inspector, 'I will examine from the book.' But the boys, being a little *upset* at the incident, answered somewhat at random. The 'Reader' was quietly placed upon the table; a well-known little red book made its appearance, and I am sure a certain person 'felt sorry he spoke.'

Let me relate another incident in connection with the same Inspector. I entered the class-room just as Mr. Fitch (he was not then doctor) was questioning the Fourth Standard in grammar, and was trying to elicit from the boys the various parts of speech the word 'walking' might be, according to its use and signification in a sentence. The boys were confused, looked vacant and stupid, and gave most unsatisfactory answers. Turning to me, the examiner said, 'These boys seem rather weak in grammar.' 'Yes,' I replied, 'they *do* seem singularly weak, but as a matter of fact they are not *so* weak as they seem. Would you mind my taking this very word 'walking' and trying what I can get out of them about it?' The result was a number of good answers, and a few very intelligent remarks. I was using the word as an adjective. One boy's sister had a 'walking doll,' which, as another boy remarked, meant 'a doll that walked,' whereupon another lad observed that it didn't always mean that because a 'walking-stick' didn't mean 'a stick that walked, it meant a stick that you walked with.' This led to a red-headed little fellow's blazing all up with excitement and exploding with the fact that 'that didn't have anything at all to do with it, because 'walking-stick' was all one word, and was a noun.' The fact was, the boys were now

free from restraint, and exhibited themselves as they really were. But *why* should they have been under restraint in the presence of so genial a nature as that of Mr. Fitch? The reason was not very remote. For some four or five weeks before the Inspection, the class-teacher had been continually referring to it. 'What do you think the Inspector will say to that sort of writing? If you don't get four sums right at the examination, I'll make it uncomfortable for you afterwards, my boy. Don't let me catch you giving a foolish answer like that on the 10th of November. That work won't suit the Inspector, I can tell you.' Such remarks as these have been dinned into the ears of the lads so persistently that the youngsters have come to regard the Inspection as a terrible ordeal which, if they do not pass through to the entire satisfaction of some gloomy monster or other, the result will certainly be a frightful, mysterious, and overwhelming calamity. What a mistake all this is! No wonder the children are nervous when the day comes! The fact is, nothing whatever need be said to the boys about the Inspection nor the Inspector, except perhaps a few remarks the day or two previously of a cheerful and encouraging nature. Our business is not to drill the children to give a certain set of answers to queries propounded by someone or other who visits the schools once a year. Our business is to educate the boys, and it *ought* to be the business of H.M. Inspector simply to ascertain whether the methods adopted and the varied surrounding influences in operation are calculated to bring this great work to a successful issue.

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NEEDLEWORK FOR PUPIL TEACHERS.

BY MISS SOPHY LOCH,

Examiner of Needlework to the London School Board.

FIRST YEAR EXERCISE.—*Cut out in calico a doll's pinafore (cottage shape). Fix and make it up as far as time will allow.*

Time allowed, one hour.

Material, 9 × 9. Arrow marks the way of the self-edge.

This appears at first to be a somewhat puzzling exercise, but with a little careful consideration we shall see that a fairly shapely little garment can be produced out of the amount of material allowed us. The shape known as the 'cottage,' is familiar to most of those who live in rural districts, but is not so well known in towns, at any rate by name. It is, perhaps, one of the most useful shapes to teach, as, if desired, it can be cut so as to entirely hide the frock of the wearer, and is capable, with very little alteration, of being turned from a very simple, homely pattern into quite a 'dressy' garment. It is proposed now, however, to deal with it in its simplest form.

This pinafore being cut, as a rule, out of material about 32 inches or so wide (viz., holland or print), we will suppose the full-sized pinafore would be made out of one width of the material (32 inches); but the material we have to work with being only 9 inches wide, we must reduce the width so as to be enabled to cut it out of this amount. We will then suppose the width to be reduced to one-fourth of the actual size, viz., 8 inches.

For a pinafore 32 inches in width, 20 or 21 inches would be found to be a good proportion as regards width. If we reduce this by a fourth, we shall have one length 5¼ inches. The amount of material therefore to be torn off will be 5¼ × 8.

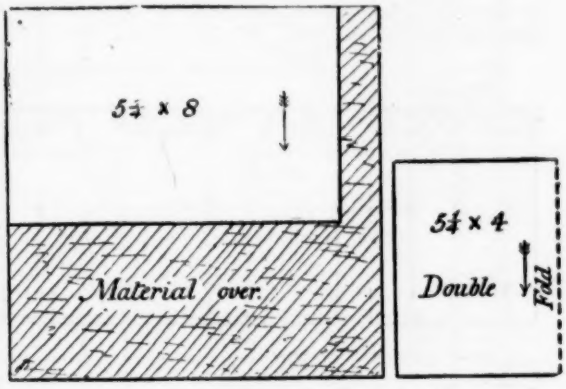

Fig. 46.

All our other measurements must be in proportion. We will first find the half of the material and double it, so that it appears 5¼ × 4 as in Fig. 46. We find the centre of this piece of material, and mark it with a small pin; we then measure one-eighth of the width of our doubled material on each side of the pin. From these latter measurements start the curves for back and front neck. These various steps are illustrated in Fig. 47.

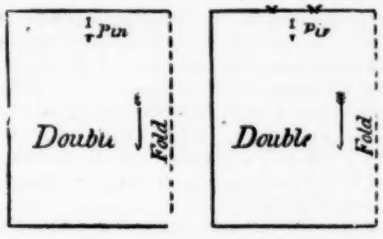

Fig. 47.

XX represent points from which the neck curves start.

The space between XX forms one shoulder. The neck curves are cut down rather less than an eighth of the width. Great care must be taken in cutting the neck curves, as if badly shaped, the hem will not set well at the neck.

Fig. 48.

We have seen that the space from X to X forms one shoulder, which is straight. There now remain to be

cut the other part of the shoulder (which is sloped) and the arm-hole. The sloped shoulder starts from the first X, counting from the two self-edges of pinafore, and slopes to the right an eighth of the width of the pinafore, stopping exactly in the centre of the doubled material. The arm-hole is cut straight from the bottom of the sloped shoulder, and measures one-fourth of pinafore width.

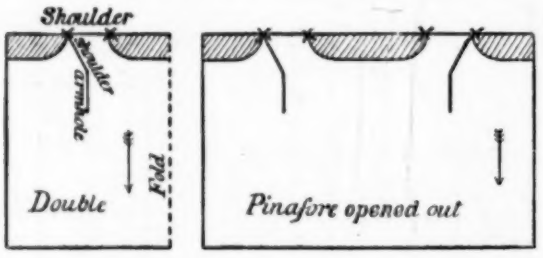

Fig. 49.

We now cut out the little pinafore in the double taking the greatest care one self-edge is placed exactly even with the other. When the garment is opened out we shall find it shaped as in Fig. 49. It will be seen the sloped part of the shoulder *is cut from the back to the front.* Let us then briefly go through the various measurements to be observed in cutting out this pattern.

1. The width of the pinafore is about once and a half its length.

2. The pinafore is cut in the double.

3. The straight part of the shoulder lies exactly in the centre of the doubled material, and measures *one-fourth* its width.

4. After the shoulder is measured, the remainder of the material on either side is hollowed out for the neck curves, the depth of the same being rather less than *one-eighth* of the pinafore width (doubled).

5. The other part of the shoulder slopes *one-eighth* of the width of pinafore.

6. The arm-hole starts from the bottom of sloped shoulder, and is cut down *one-fourth* of the width.

7. Should greater length and breadth be required for this pinafore, the other parts must also be cut in proportion.

Making-up of Pinafore.—The straight and sloped shoulders are first joined together by a sew and fell seam, the straight part being the one to be turned down twice. The correct rule will then be followed for seams going across the self-edge, viz., the seams will fall to the front, the fells to the back. After working the shoulders, it will be necessary to shape slightly both neck and armhole. The latter should then be turned down and hemmed. The neck should now be arranged for a hem, the edge being first stretched. If this is done, and the neck curves have been properly cut, no difficulty should be found in making the neck hem lie without any pucker. The sides of the pinafore must now be turned down and hemmed, and, if time permit, the bottom of the little garment should be treated in a similar manner. The length when finished should be about five inches.

This exercise will appear very clumsy unless the strictest accuracy is used in cutting it out, and the greatest neatness employed in its execution. The calico used should be soft and not coarse, and the cottons and needles should be of suitable size; the hems should be narrow, and great care taken with the general finish.

(To be continued.)

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CONVERSATIONAL DRAWING LESSONS FOR INFANTS.

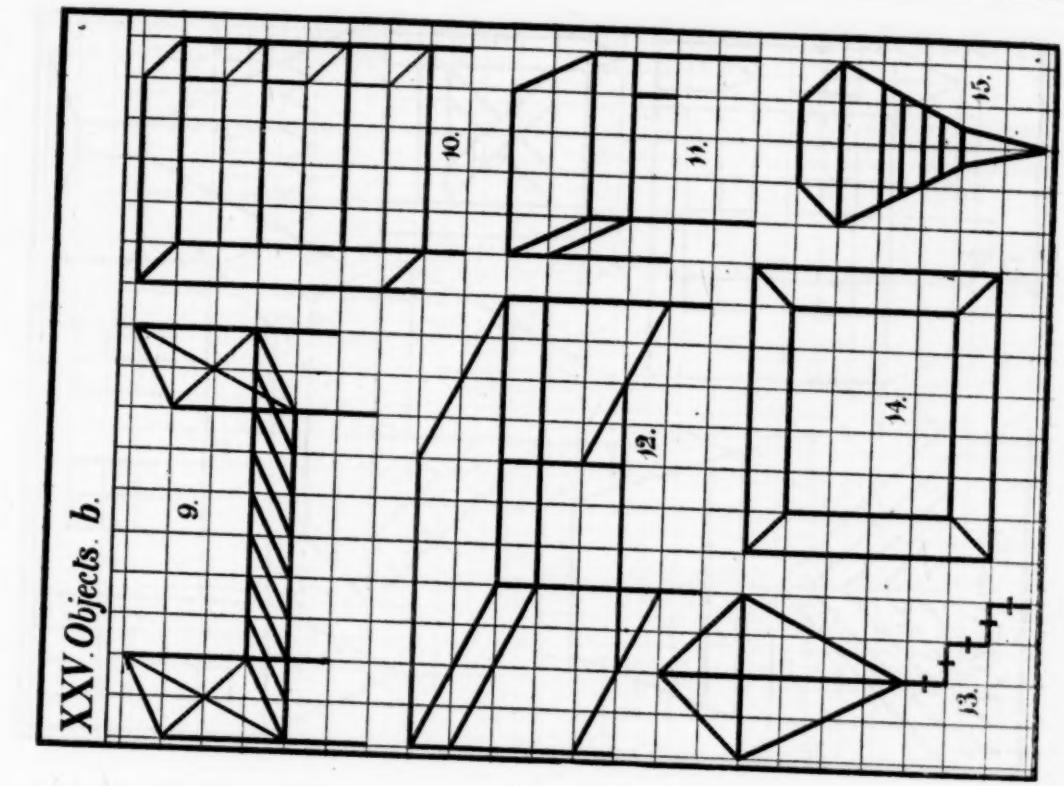
BY MRS. E. MORTIMER,

Author of Practical Kindergarten Lessons for English Infant Schools; Lecturer on the Kindergarten at the Home and Colonial Training College.

XXV. Objects. Pattern 15.

The children to have chequered drawing-books and nicely sharpened pencils.

After a few questions on the different kinds of lines, the teacher would begin by drawing a horizontal line on the blackboard. How long is this line? Two squares. Where did I begin? At the second square. That is right; I began at the second square from the left. You may all draw a line like that. Now look again; what have I drawn? Another horizontal line below the first. Is it quite like the first? How is it different? It is longer. How many squares? Where does it start from? From the first square. Very well, then you may draw one like it. How many horizontal lines have you? Now look at the board again and tell me what I have drawn? An oblique line. How long is it? It is the diagonal of one square. Can you tell me anything else about it? It joins the two horizontal lines together. Yes; and now draw one to join the other ends. Do you see any difference in those two lines? That is right; they slant in different directions. Now you must watch very carefully while I draw the next line. Where have I begun it? At the first corner. And now what have I done? Drawn an oblique line through two oblongs. Yes; but I do not want quite such a long line so I am going to rub some out. There; now who can tell me how much I have rubbed out? That is quite right; half the line that goes through the second oblong. Where does the line really end? On the middle of the horizontal line. I should like you to try to draw a line like this on the other side. You must be very careful. That is very nicely done. Now I want a horizontal line to join the ends of the two oblique lines. How long is the line? One square long. But you have a vertical line running through the middle of it. Yes, because we have to count a half on each side of it. Yes, the line being drawn on two halves makes it one square long. Look at your drawing and point to the longest horizontal line. How long is it? Now draw a line on the horizontal line below this so as to touch both the slanting lines. How long is this line? Well, let me help you count. How many whole squares? Three. And what else can you see? A half at each end. Yes, that is right. Well, now, how long is the line? Four squares. Now draw on the line below this. How long is the line you have just drawn? Yes, just two squares. Now, I have something very difficult for you to do. What do you think you should do when you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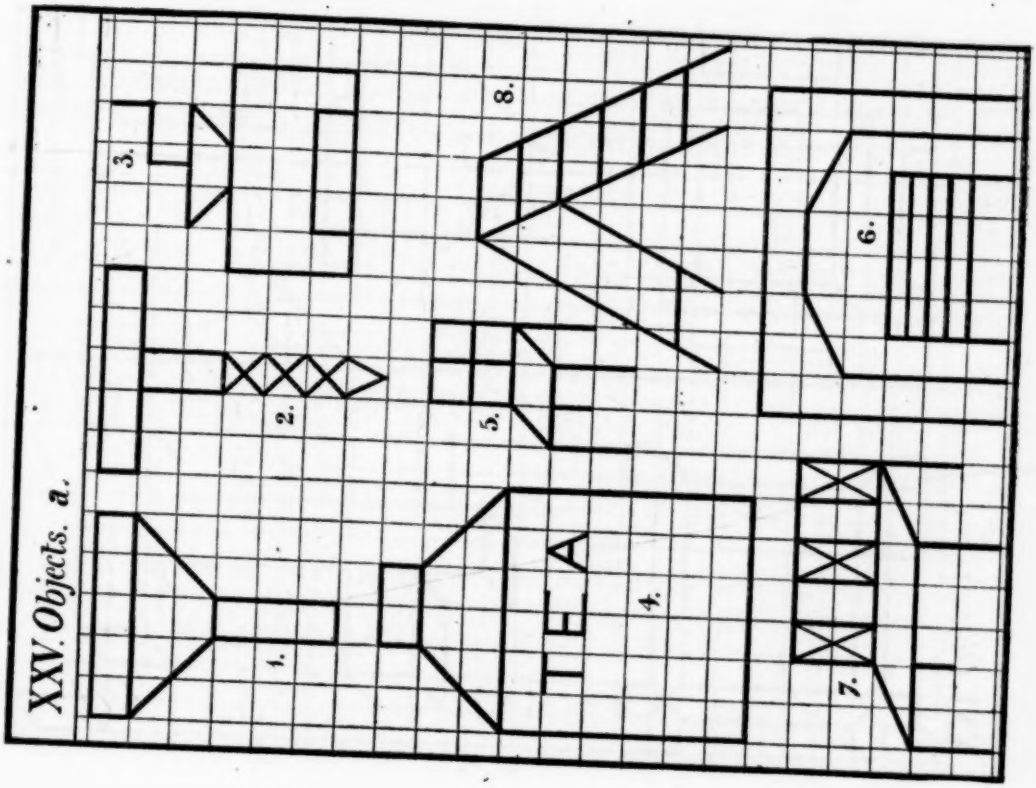
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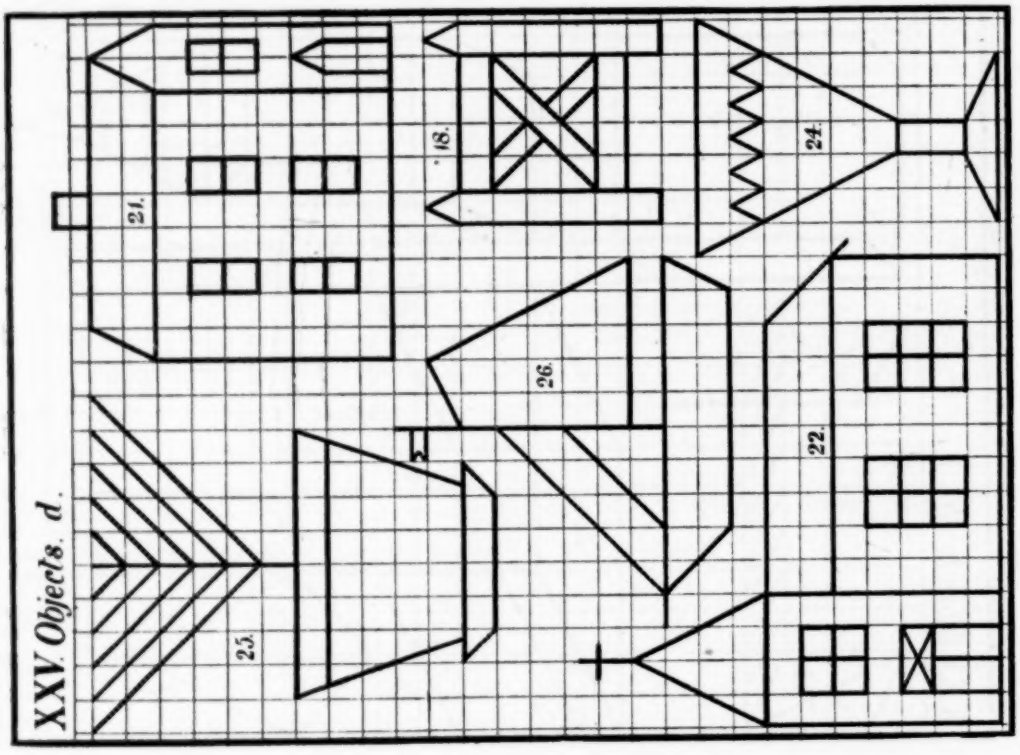
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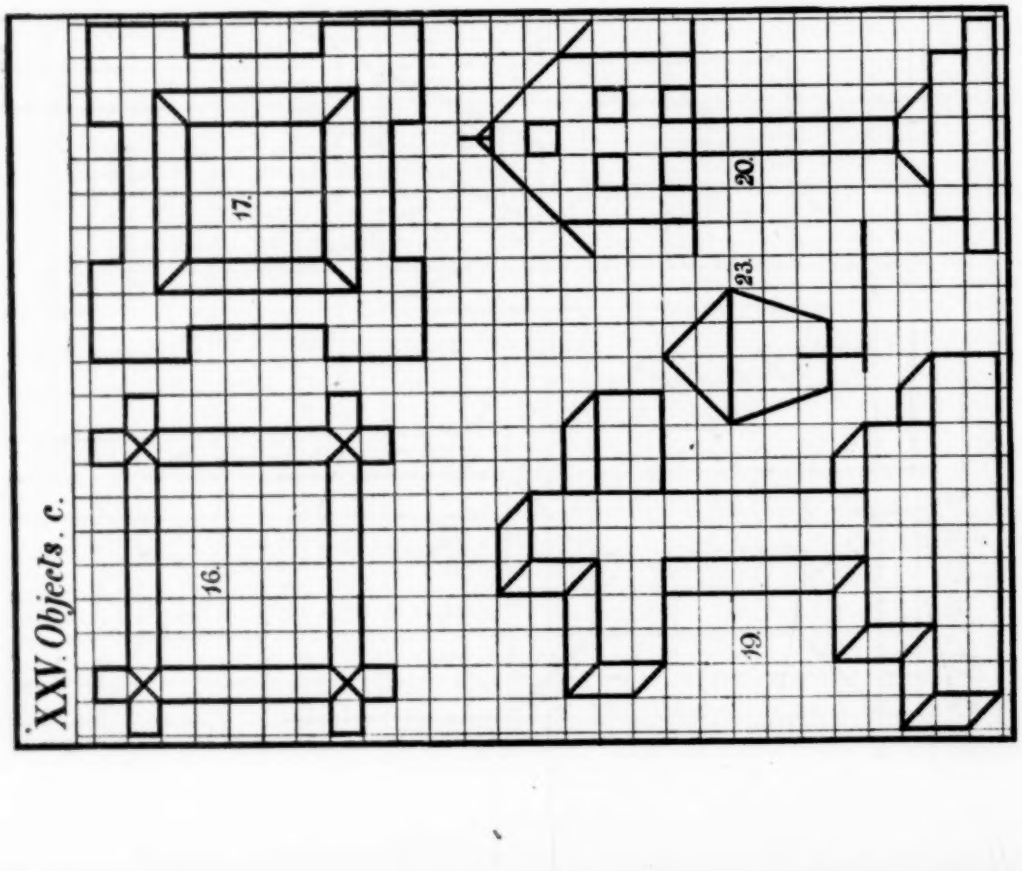
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find you have something difficult to do? We should watch very carefully and try all the more to do it right. Well, then, I want you to draw a line between the last two. Why is this difficult? There is no line to help us. Watch me draw it on the board. There, now you may try. I think that is very nice. I am sure you must all have tried very hard. Now I want you to draw another between the two bottom lines. I will draw it on the board first. Now count and tell me how many horizontal lines you have drawn? Yes, you have drawn seven; there are still two lines to draw before we have finished our copy. There, I have drawn them. What kind of lines are they? Slanting lines. Where do they begin? At the ends of the bottom horizontal line. And where do they finish? At the corner, two squares below. Yes, they meet together here. Now let me see you all finish this. Can you tell me what we have drawn? Yes, it is a top. What is a top? Who plays with it? Yes, I expect all you boys have tops. What do you do with them? What do you have to do to make them spin? Where do you begin to wind the string? See, here is a real top. Who can wind the string on it? Which part of the top is this? The peg. Of what is it made? Do we put the string round that? Come, Harry, and wind the top for us. Of what is the other part of the top made? For what are these marks on the top? You do not know. Well, they help to keep the string from slipping off when you are winding it. Can you spin a top the first time you try? No; you have to try several times before you can spin it nicely. Well, now I think you might draw another top, and see if you can make the lines even better than you did before.

(*To be continued.*)

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NEW COMPOSITION STORIES.—STANDARD V.

Suitable for 'Unseen Tests' in Reading also.

No. 217.

A Cool Bird.—Two sailors once went with a tame parrot to a show, where a conjuror was giving an exhibition of his skill. At the end of each trick the sailors said, 'Now, wasn't that clever? Wonder what he'll do next?' The parrot heard this exclamation so often that he at last learnt to repeat it. Presently the conjuror undertook to keep in the air a number of bamboo sticks ignited at both ends, but, having his attention distracted by a movement in the audience, he allowed one of the sticks to drop. Unfortunately, it fell upon a heap of crackers and gunpowder, which exploded and blew out the walls, took off the roof, scattered the audience in all directions, and sent the parrot, minus its tail feathers and one eye, about four hundred yards. As the bird came down with a flop, it shrieked, 'Wasn't that clever? Wonder what he'll do next?'

No. 218.

A Bishop's Umbrella.—The late Bishop Hannington seems to have carried his umbrella about with him wherever he went. This turned out rather a lucky habit for him, as the following incident will show. One day he was taking a walk, as his manner was, in the jungle. As he sauntered along a pretty little creature like a puppy came up and fawned upon him. Nothing fearing, he picked it up and fondled it, while the natives, greatly terrified, fled from him on all sides. It was a lion's whelp which the kindly missionary had taken to his bosom, and it is not to be wondered at that the young one's parents came quickly upon the scene. The Bishop never lost his presence of mind for a second. Quietly he dropped the cub, and, seizing his umbrella, spread it out, and gallantly charged the lion and lioness. Never before, possibly, had a sedate Bishop behaved in such a manner. He danced and yelled around these wild animals for some minutes, while his umbrella went spinning round and round like a top. The lion and the lioness were stricken at once with great fear and trembling, and deeming flight the better policy, they turned their backs on the Bishop, who, lowering his umbrella, discovered himself to be alone.

No. 219.

A Lucky Sixpence.—A draper found a sixpence on the floor of his shop. Being an honest man, he put this notice in his window: 'A sum of money found on Tuesday last in this establishment. The owner will receive the same upon describing the amount.' Hundreds of people called and announced the loss of various sums of money, ranging from two shillings up to hundreds of pounds. But no one announced the loss of a sixpence. All who called spent money in the shop, and a merry twinkle glitters in the honest draper's eye as he looks at the lucky sixpence which has brought him so much trade.

No. 220.

The Old Miser.—A gentleman called upon a rich but miserly old nobleman, and found him endeavouring to catch a fly. Presently he succeeded in entrapping one, which he immediately put into the sugar bowl, afterwards shutting down the cover. The gentleman, asked him for an explanation of this singular sport. 'I'll tell you,' replied the miser, and a triumphant grin overspread his countenance as he spoke, 'I want to ascertain if the servants steal the sugar.'

No. 221.

An Easy 'Bull's-Eye.'—A gentleman living in the country made considerable fun for himself and his friends recently. He is by no means a good marksman, and, when he took half-a-dozen of his friends round to the back of the house one morning and showed them a bullet imbedded in the bull's-eye of a target, neatly painted on a barn door, the natural inquiry was: 'Who fired that shot?' 'I did, at a distance of two hundred yards,' said the gentleman. 'Nonsense! You couldn't have hit the barn at that distance,' were the comments of his friends. But the gentleman was persistent, and brought two witnesses, who declared that they had seen him with a rifle, standing at a distance of two hundred yards, put the bullet where it was. The witnesses were above suspicion, so the visitors said no more; but during the conversation at the dinner-table the gentleman confessed that he had painted the target on the barn *after he had fired the shot.*

No. 222.

What Happened to His Hat.—A lecturer at a certain college once made himself obnoxious by warning the students against putting their hats on his desk. The college was remarkable for a scarcity of cloak-room accommodation, and in the rush to be in time, hats used to be flung down anywhere. One day, finding several on his desk, the lecturer announced that if he found another there he would rip it up. Warned by this, the students, when they assembled on the next day, took good care not to offend again in this manner. Presently, however, the lecturer was called out of the room. Then a naughty student slipped from his seat, took down the lecturer's own hat, and placed it on his desk. When he re-entered the hall every eye was fixed on him. He observed the hat, and a gleam of triumph shot across his face. 'Gentlemen,' he said, 'I told you what would happen if this occurred again.' He then took his knife from his pocket and cut the hat in pieces amidst prolonged applause.

No. 223.

The Dog and the Muzzle.—A lady had a beautiful dog named Topsy. This dog was greatly petted by all the family, and was generally allowed to roam where he pleased. One hot summer, however, the magistrates of the district ordered that no dog should be allowed abroad without a muzzle. The thoughtful mistress procured one that would give her dog the least possible discomfort; but every time Topsy was taken out she made strong efforts to free herself of it. It happened one day that it was not fastened so securely as usual, and the dog managed to get it off. The mistress stooped down to refasten it, but Topsy was too quick for her. She caught up the muzzle in her mouth and made off as fast as possible to a pond in the neighbourhood. On arriving there, she plunged in, swam to the deepest part, and then dropped the muzzle into the water. She then hastened back to her mistress, expressing by her manner the greatest delight.

No. 224.

Couldn't Make a Mistake.—A young clerk went into a branch of a certain bank the other day and tendered a cheque for twenty pounds, receiving in exchange gold and silver to the value of twenty-one pounds. The clerk did not notice this till he

reached his office, then instantly returning to the bank, said to the cashier who had paid him the money—'Are you aware that you made a mistake a few minutes ago?' 'Mistakes are never made here,' instantly answered the cashier. 'But you gave me twenty-one pounds instead of twenty.' 'I tell you,' the cashier responded in a very dignified tone, 'this bank never makes mistakes.' The young clerk said no more, but walked away a pound richer than when he entered.

No. 225.

THE CAPTAIN'S JOKE.—Captain Middleton was extremely fond of practical jokes, but occasionally he met his match. He was staying in a country house, and one of the party, a hunting man, came down to dinner the first evening attired in a red coat. The captain chaffed him greatly, and dared him to put on the conspicuous garment another evening. Nevertheless, the following night the red coat reappeared. This time Middleton said—'I say, Smith, if you put on that coat again I'll take a knife and slit it up the back from top to bottom.' 'Very well,' said the other quietly, and the third night he again appeared in a red coat. Thereupon the captain snatched up a carving knife, went behind him, and divided the coat in two. The gentleman merely smiled and went on calmly eating, to everyone's surprise. At last his persecutor said, 'Why don't you get in a rage, or do something?' 'I don't mind,' was the calm reply; 'it's your coat.' He had gone to Middleton's room, unpacked his coat, and put it on for the occasion. The captain never played a joke of that description again.

No. 226.

KINDNESS REWARDED.—Many years ago a young man was going up to Oxford by coach, to continue his studies at the University. His mother was a widow, and it was only through her care and self-denial that she was able to give her boy the advantage of a good education. When about twelve miles from Oxford, he found to his dismay that he had lost a £10 note that his mother had given him. He remembered that some time before he had taken out his purse, and thought that the strong wind must have blown it away. After walking two or three miles he met an old man who was terribly afflicted. In spite of his anxiety about his loss, the youth stopped and spoke to him out of pity. Finding the old man was on his way to Oxford for advice, he offered to give him a note to a kind person there. He put his hand in his pocket, but could not find a scrap of paper. Suddenly the old man bent down, picked up a piece of paper from the road, and asked if he could not write on that. To his surprise this was his very bank-note. His kindness to the old man, instead of hindering his search for it, was really the means of his finding it.

No. 227.

THE PIGEONS WERE DESPATCHED.—Before the introduction of the telegraph, the editor of a newspaper sent a reporter to Brussels to take down the King's speech, and with him a couple of carrier pigeons to be despatched, each with a copy of the document. At Brussels he gave the pigeons to a waiter, and called for breakfast. He was kept waiting some time, but a very delicious stew made up for the delay. After breakfast he paid his bill, and asked for his pigeons. 'Pigeons!' exclaimed the waiter; 'why, you have eaten them!'

No. 228.

A CONVENIENT PAPERWEIGHT.—A priest was about making a journey. Many friends called to say good-bye, and, as had happened before, each gave him a paper on which was jotted down a list of things which the writer wished the traveller to purchase for him. Only one friend, however, furnished him with the necessary money. This commission the priest carefully executed, and delivered the articles. When the others called for their goods, he said: 'Soon after I sailed I took out all your papers to look them over and classify them. I laid them on the deck before me. Suddenly there came a gust of wind, and they were all blown away. I could not remember what they contained, and so I could not do your errands.' 'But,' they objected, 'you brought what Mr. Jones asked you to get.' 'Oh, yes,' said the priest. 'You see, he enclosed the cash with his order, and that kept it from blowing away.'

No. 229.

A CUNNING FOX.—The proverbial cunning of the fox was well illustrated in a late run of some hounds, by which the pack was placed in considerable peril. The 'find' took place in a wood, and the fox, after starting at a good pace, tried in vain to conceal himself in a bed of rushes. He was speedily compelled to quit his hiding-place, and then made for the railway, where he deliberately lay down on the permanent way, and refused to move. An express train was rapidly approaching, and the pack, in danger of getting upon the line and being cut to pieces, were reluctantly and with considerable difficulty drawn off by the huntsman. The fox maintained his position until the express got within a short distance, and then quietly made off—as some may think he deserved to do—in safety.

No. 230.

BEAUTIFUL HANDS.—Three ladies once disputed as to which of them possessed the most beautiful hands. One dipped hers into a clear stream; another plucked strawberries until her fingers were pink; and the third perfumed hers with violets. Just then a poor woman passed, and asked for charity. The three ladies refused her; but another who sat near, gave her all she possessed. The poor woman then asked the ladies what had been the subject of their dispute. On being told, she exclaimed—'Beautiful hands! Why, they are all beautiful; but the most beautiful is the one that is filled with kindness to the needy.' The old woman then departed, leaving the ladies to reflect on what she had said.

No. 231.

THE MILKMAN'S CONFESSION.—A German had made a fortune in Liverpool by selling milk. He started home with two bags of sovereigns. On shipboard, while he was counting one of his bags of treasure, a mischievous monkey was watching his operations. As soon as he had replaced the money and tied up the bag, the monkey snatched it up, and was soon at the masthead. He opened the German's bag, and, after eyeing the pretty gold, he proceeded to drop one piece on the deck and another in the water until the bag was emptied. When he had finished, the German threw up his hands, exclaiming, 'He must be a spirit, for what came from water he gives to the water, and what came from milk he gives to me.'

No. 232.

AN INTELLECTUAL DOG.—The master of a clever dog was fond of hot rolls for breakfast. He placed a penny each day in the dog's mouth and said to him 'Baker.' The dog would then start off for the baker's. Arrived there, he placed his feet on the counter and presented the penny to the proprietor of the shop, who, taking the money, placed a bag containing a penny roll in the dog's mouth. This the dog used to bring safely to his master for breakfast. One day the dog as usual brought his penny to the baker's counter. The man, to see what it would do, placed a *halfpenny* roll in a bag and deposited it in the dog's mouth as usual. The dog put down the bag on the counter and *went out and fetched a policeman!*

No. 233.

A QUEENLY BEGGAR.—During the war between Russia and Turkey, many Roumanian soldiers were wounded, and the Queen of Roumania, who constantly visited the hospitals, found that some of the patients died because they chose death rather than disfigurement. It occurred to her, that if one yielded, others would follow; and one day, when the surgeon was turning away from an obstinate patient, she approached and added her own entreaties. The soldier said that if his leg was amputated, he should only be taken for a beggar. 'And this I am not,' said he proudly; 'I will lose my life, but not my honour.' 'It is true,' said the queen, 'you are not a beggar, but I am; I have never prayed but to God, but now I supplicate you to listen to His wish and mine. Let your leg be taken off, and spare your life to your family, to your country, and to me.' 'And if I consent, lady, what then?' 'Why, then,' she said joyfully, rising and seizing his hand, 'I will give you the most beautiful cork leg in Europe; and, when the war is over, you shall come and dance at the palace.' 'I consent,' he said softly; 'but you must hold my hand during the operation.' After that there was no more opposition to the doctor's wishes, since they were also those of their beloved queen.

No. 234.

A FAITHFUL DOG.—A short time back the engine-driver of a train near Montreal saw a large dog on the track. He was barking furiously. The driver blew the whistle, but he did not stir, and, crouching low, he was struck by the locomotive and killed. There was a bit of white muslin on the engine, and it attracted the attention of the driver, who stopped the train and went back. There lay the dead dog and a dead child, which had wandered upon the track and had gone to sleep. The dog had given his signal to stop the train, and had died at his post.

NEW DICTATION TESTS.

Suitable for 'Unseen Tests' in Reading also.

STANDARD IV.

No. 179.

So familiar with man is the swallow, that it will often enter inhabited houses through a broken window-pane and construct a nest on any convenient shelf or ledge. Brackets and picture-frames are among the many strange places it has favoured. It has built in the loop of a chain and in the bows of a boat. One was in the habit of building on the wings and body of a dead owl hanging from a rafter, and when this was removed and a large sea-shell fixed in the same place it made this its nesting-place. Still, if they are persistently disturbed in any locality they will soon leave it.

No. 180.

Many amusing stories are told of the way in which tea was prepared by those who had not heard how to prepare it. In many cases, the leaves were boiled and the liquid thrown away. The leaves were then eaten in various ways, in one case being strewed on bacon. The Chinese take tea perfectly clear, while the Russians use lemon juice instead of sugar and milk. Tea possesses many valuable qualities, and though it is perhaps not a suitable drink for children, yet it is one of the world's most useful and most harmless beverages.

No. 181.

From his earliest years, Mr. Wood, the naturalist, kept pets of every kind, not only cats and dogs, but toads, snails, blindworms, grass-snakes, tortoises, lizards, scorpions, insects, an injured bat that consumed seventy bluebottle flies every night, and a chamelion that was killed by a cat in a fit of jealousy. It was his business and pleasure to make the study of natural history so simple and interesting that no one who heard his lectures or read his books could fail to understand the wonderful habits of the dwellers in the animal world.

No. 182.

The apple well repays careful treatment, but its life is often blighted and the grower's hopes cut short by disasters of one kind or another, by late frosts and rough weather. It would be interesting to know whether the common ancestor of all the apples—the crab-tree of the country hedge-row, feels the cold as keenly as its more highly cultured children. All other fruits that we grow, except the gooseberry, the strawberry—perhaps the raspberry—and the hazel-nut appear to have been unknown to our ancestors, at least as natives. Their names have all been borrowed from some alien tongue.

No. 183.

Those flat-bottomed little steamers which scud so swiftly along the waters of the Seine with their living freight are to be covered over in winter to shelter passengers from the rain. Already there is a contrivance for fixing a flat awning over them on sunny days. The difficulty in the way of covering them all over with tarpaulin lay in the fact that such a covering if too high was in the line of sight of the man at the tiller, for wheels are not used on these boats. Doubtless the difficulty would be still greater in the case of our penny steamers.

No. 184.

Some of the alleys in Edinburgh are so narrow that it is possible for persons to shake hands out of the windows of the houses on each side. A few of these lanes are now occupied by factories and warehouses, and many are tenanted by the very poorest of the poor. A hundred years ago, however, they contained the abodes of the noble and the rich. Most of them are very picturesque, especially on washing day, when the clothes are hung to dry from poles and rigging run out from the windows.

No. 185.

Three men were rendered unconscious a short time since by the fumes of gas while cleaning out a stove connected with a blast furnace. A doctor was sent for, and he in the most plucky manner ascended to where the men were working, at the top of the stove, which was 60 feet high. He then lashed himself to a rope to prevent his falling, and for fully an hour applied artificial respiration to the men, his efforts being finally crowned with success.

No. 186.

The biggest ruby in the world is said to be found in the Czar of Russia's crown, which has the distinction of being the finest ever worn by any sovereign. In shape it resembles a bishop's mitre, and on its crest is a cross composed of five superb diamonds, which support the biggest ruby. An arch composed of eleven magnificent diamonds supports this cross, and on each side is a loop of thirty-eight pearls.

No. 187.

There is no better month than November for watching bird-life In April and May they are all of them love-making and building their nests. In June, July, and the following months the abundant foliage rather baffles the investigation, but by the middle of November birds cannot well avoid living in the open, and exposing their ways and habits to the gaze of the curious. This month, however, would hardly find the champions it deserves if the ear were the only sense it gratifies and captivates.

No. 188.

Everyone frequenting the forest glades may learn so much of trees and plants as readily to name one when he sees it and to arrange it in the class to which it belongs. When he has so arranged a plant he knows many of its habits and qualities—whether it delights in moist or dry places, whether it is an annual, or whether it possesses useful qualities. It is not very difficult to obtain sufficient knowledge of insects to be able to classify an insect in the same way.

No. 189.

Every May-day morning at five o'clock a Latin hymn is sung on the top of one of the beautiful towers in Oxford by the men and boys of the college chapel. After the grace, the bells ring out a merry peal. Hundreds of sightseers are attracted to the spot. Hearers they cannot be called, for the urchins of the city cause such a din in the street by the blowing of small horns that the music aloft is heard only now and then above the noise of the penny trumpets. It is not easy to tell how this custom arose. Music of some kind, it is believed, has been sung on the tower-top every first of May since 1498. Some authorities trace in this quaint ceremony an allusion to a feast of classic times.

No. 190.

Assisted by the French Government, the poor Arabs have been waging war with crickets for years past. Thousands of pounds have to be spent in digging trenches and erecting barriers of calico attached to stakes driven in the ground. Besides the money spent in calico, stakes, cords, steel fastenings, and zinc to line the trenches, 850 workshops and offices have been established, and nearly 100,000 people have been employed in the work, guarded by detachments of French soldiers. The crickets climb a cornstalk, and with their scissors cut off the beard and husk, then they open every grain and eat it.

No. 191.

Experiments in various parts of the world will soon determine the much-discussed question of rain-making. It is stated, and generally accepted, that nearly all the great battles since the advent of heavy artillery have been almost immediately followed by heavy downfalls, supposed to be due to the disturbance of the atmosphere by the discharge of heavy ordnance. This has suggested the idea of disturbing the atmosphere by means of explosives sent up among the clouds in balloons.

No. 192.

A mechanical engineer of some note has been addressing a scientific audience upon the question of calming the ocean waves in storms by oil. The frequent failures that have been experienced in this direction he ascribes to a too indiscriminate use of oils. Petroleum, and mineral oils, he says, are quite unsuitable for the purpose, even when poured by gallons into the sea. Train oil, on the other hand, is extremely effective. Even so small a quantity as half a gallon an hour will, he contends, secure a large vessel against danger.

No. 193.

There is always plenty of bustle at the General Post Office between half-past five and six o'clock in the evening. Men and boys are racing up the steps, some carrying only single letters, others with baskets full, and others bearing great bags stuffed with so many letters that it is as much as two men can do to carry them. As the

hands of the great clock point nearer to six the excitement becomes greater. Messengers come tearing up quite breathless, and the policeman who stands beside each box is pushed aside by the eager crowd. Just at this time he can hardly manage to keep his position, much less attend to the thousands of envelopes which are being poured into the great opening beside him.

No. 194.

The wild dog has keen scent, quick intelligence, great powers of endurance, and great speed; so that, however swift may be the animal pursued, it has cause to fear this tireless hunter. Indeed, it never seems to take into consideration the size, strength, or agility of its game. Even the lion, it is said, has learned to dread those small hunters, which seem to have no fear of death, but rush with fierce courage to attack the mighty monarch himself, should he be so unlucky as to become the object of their pursuit.

No. 195.

All are architects of Fate
  Working in these walls of Time;
Some with massive deeds and great,
  Some with ornaments of rhyme.
Nothing useless is, or low;
  Each thing in its place is best;
And what seems but idle show,
  Strengthens and supports the rest.

STANDARDS V.—VII.

No. 162.

Diseases of the eye are increasing at a rapid rate, and it may be feared that one or two more generations only will be necessary to reduce all the children to the use of spectacles from infancy—a lamentable state of things which is already observable in Germany, no doubt from the evil effects of their black-letter type during childhood. Whilst our only idea of education continues to be that of the brain, to be conducted through books, the long hours of poring over black and white must necessarily affect our children's most precious gift of eyesight; but it may be hoped that healthy teaching of the hand, especially in such subjects as horticulture and fruit growing, may tend to counteract the sad effects of too much reading by supplying the relief of the open air and the soft tints of nature to overworked brains and strained eyes.

No. 163.

At Covent Garden Market English goods are disposed of mostly by private sale, either to middlemen in the market or to the retail shopkeepers. The foreign goods are sold by auction to all classes of the trade. Some of the auctioneers have regular growers, who send them, say, French pears in cases. These French growers allow a little slip of coloured silk to hang out of some of the cases, and these are the sample cases, a fact well known, of course, to the auctioneer and his porters. Out of a consignment of 1,000 boxes there may be ten or twenty of these sample cases with the coloured silk, which is too small for the uninitiated to observe.

No. 164.

The ostrich-feather is characterised by having the quill exactly in the centre of the feather, while in other birds it is a little on one side, causing the fringe on either side to be of unequal width. The elegance of the feathers, arising doubtless from their beautifully tapering shafts and delicate gossamer webs, has led to their being valued highly as articles of ornament in all ages. The Egyptians are supposed to have venerated them as a symbol of justice, from the fact of the width of the webs being equally balanced on both sides of the shaft.

No. 165.

According to intelligence from Russia, the hospitals are filled to overflowing with sufferers from typhoid fever, which has developed to such an extent that the Municipal Councils have decided to erect temporary hospitals solely for the treatment of the patients. This unfortunate state of affairs is attributed to the influx of peasants from the famine-stricken districts, who while waiting for work are badly nourished, and live in unsanitary conditions, thus falling easy victims to the disease.

No. 166.

The common opinion that kangaroos use their strong, muscular tails as a means of propulsion in their flying leaps, which often cover from twenty to thirty feet each, is at once seen to be fallacious by anyone who joins in a kangaroo hunt. When sitting erect in an attitude of observation the tail is used as an important factor in the support of the body, and when the animal is feeding—at which time it moves about in a lazy, crawling gait upon all four of its feet—it drags limply over the earth. In running, however, it is curved gracefully upward to clear the ground, and never once touches it during the kangaroo's flight, being seen to fulfil the office of a balancing pole, and preserving the animal's equilibrium by shifting positions according to the nature of the ground.

No. 167.

While we must recognise the conservative tenacity with which the most favourite toys of our children have been retained with scarcely any important modification in their design and mechanism, it behoves us to remember that the world owes much of its enjoyment in the way of toys to the equally industrious and imaginative artisans of the middle ages, especially to those of Germany, and also, in all probability, to the ingenuity and the tender sympathy with childhood of the mediæval nuns. The good sisters of old, however, would not appear to have been experts in the art of illumination.

No. 168.

The late Duke of Devonshire was a great agriculturist, and a scientific breeder of shorthorns. He brought, in fact, unusual intellectual strength and immense means to the most practical work of life, and succeeded at once as student, as man of science, as ironmaster, and as agriculturist. A fuller, more interesting, or more useful life can hardly be conceived, and amidst it all the duke remained almost silent, though he exerted, it need not be said, considerable political influence, always at first on the Liberal, and afterwards on the Liberal Unionist side. He, at all events, justified his dukedom.

No. 169.

H.M.I.'s TEST.—Telegrams state that the Scilly Islands have been visited by a severe attack of influenza, which has spread in all directions. Whole families are down with it, many of the cases being of a serious character. Fresh cases are breaking out almost hourly. The situation is aggravated by the fact that the only medical man on the islands is himself stricken down with the disease, and his services, therefore, are not available. Some parts of North Devon are also severely visited by the epidemic, and several deaths are reported to have occurred.

No. 170.

A troop of kangaroos in flight affords a strange spectacle. In passing through loose shrubbery, they look more like an equal number of men on bicycles than anything else, with their bodies bent forward, and stringing along in Indian file, as is their invariable custom. They are wonderful jumpers, and sail over the highest fences with perfect ease. The wire fences, now so generally in use on the stations, however, seem to puzzle them, and they will turn from these obstructions and follow them for miles in search of an opening, rather than attempt to leap them. This peculiarity is also taken advantage of by sportsmen to their destruction. Shooting them with a rifle requires a large degree of skill, and it is only after much practice that one unaccustomed to measuring distances over the flat plains can get their range.

No. 171.

The Venerable Archdeacon of Westminster, in the course of an address, before a large audience of young men, at the Polytechnic Institution, Regent Street, spoke of true manliness, and remarked that it was a very common mistake of the young to regard as manliness a mere precocity in vice. His life had been largely passed among the youths of this country, and over and over again he had seen youths made popular idols and favourites because they were thought to be 'such fine, manly fellows,' when really the mark upon their forehead was selfish indulgence in amusements, and the giving up on all occasions what was their duty for their pleasure. True manliness meant self-respect and resistance.

No. 172.

It is always good policy to try to forget disagreeable things, turning from them to something more hopeful and promising. Unless it is clear that complaining will do some good, it is waste of time to

complain. For the sake of one's own temper and capacity to enjoy long life, we should cultivate cheerfulness and hopefulness, and think no more about disappointments than may be necessary for the learning of such lessons as they convey. A disappointment is, after all, not the loss of anything already in possession, though we may have believed it to have been in possession; it is simply a failure of one's hopes or expectations, and the remedy is to form new hopes or new expectations—to turn away from the disappointment and look forward to that well-spring of happiness, the future.

No. 173.

H.M.I.'s TEST.—A commodious building, costing some £3,000, was opened last week by the Archbishop of Canterbury, and will soon be in full working order. It is designed to accommodate 320 students, and to continue the technical instruction which has been so successfully carried on hitherto by the adjacent Church of England Mission. The Archbishop, in the course of his inaugural address, congratulated the Corporation of Croydon upon the zeal which it had exhibited in the promotion of technical education, and affirmed that with the success of the movement the future happiness and prosperity of the country were largely bound up.

No. 174.

The enterprising Telephone Company now supplies subscribers with a complete church service, not only prayers, responses, singing and sermon, but including also the tolling of the bell, and even a casual cough from any member of the congregation. This new departure confers a great boon on many persons, especially the sick and bed-ridden, and also those whose callings require them to be on duty even on Sunday. It is stated that some sixty persons are now in regular attendance at church, at least in hearing, if not in person, who would otherwise be unable to attend service.

No. 175.

Many people fall ill of disease simply through fear of it. The imagination has a powerful influence on the human body. One can easily imagine himself to be catching cold, and will really catch cold at the sight of an open window, when if he did not know the window was open, or was not afraid of its effects, he would escape the cold. Doctors understand this secret, but they do not impart it to their patients. Most invalids, real or supposed, would be angry if a physician were to say to them, 'Nothing ails you, you only think so.' They prefer to think themselves sick, and in time they really become so, for nature, though she struggles hard, cannot stand everything. When they have a headache, instead of dieting or eating more moderately, they take several drops of some nice poison. They trust nothing to nature, but call in a doctor for every little ailment, when fresh air, exercise, and strict temperance in eating and drinking is all they need.

No. 176.

It is surprising that people attach so little importance to butter as an article of diet both for themselves and for their children. Children, especially in winter, should have as much butter as they will eat, leaving it to them to stop when they have had as much as they care for; not melted butter, of course, which is an abomination, but the article in its natural state, pure and unadulterated. Butter is the most easily digested of all the fats, and this fact it is that constitutes its prime value as a species of food. Fat means heat, and heat means energy, which is only another name for vitality; and if the little ones are plentifully supplied with it, many a doctor's bill may be avoided, and many a pint of nauseous cod-liver oil will be rendered unnecessary.

No. 177.

Never relinquish the great object of your ambition whatever it may be. Let it be, more or less distinctly, ever present in your mind. Let it exert a controlling influence over all your actions. In the first place, have some definite aim to your life, some distinct and leading object of your ambition, and be ambitious to accomplish it. An aimless, objectless life is a dull and dreary waste. It lacks stimulus, zest, and enjoyment. In choosing an object of ambition choose a worthy one, in behalf of which all the strength, all the higher and nobler faculties of your nature may be enlisted. Have an aim that you may unblushingly and proudly exhibit to the light of day, for which you may safely challenge the respect of all. Then pursue it earnestly and steadfastly. No matter what discouragements assail you or present themselves in your way, keep right on in the pursuit of your object.

NEW READING TESTS.—STANDARD III.

Suitable for 'Unseen Tests' in Reading also.

15.—An old peasant woman made her first journey by train last week, after being assured many times that it was quite safe. Hardly had the train moved out of the station than the guard's alarm bell rang violently, and the train was soon stopped. After much excitement, it was found that the old woman had raised the alarm, and she coolly said to the guard: 'Just run back and tell my son that I forgot to feed the fowls.'

16.—At a certain timber-yard in India the elephants knew when it was Sunday, and nothing would induce them to work on that day. On week-days at six o'clock a bell was rung showing that work was over for the day, and even if an elephant were in the act of placing a log on the pile, at the sound of the bell he would instantly let it drop, and walk off to his shed.

17.—[**H.M.I.'s TEST.**]—Before she had finished breakfast he was off to school, and she had to hurry so much that she forgot all about the kitten. As soon as school was over she began her search for a home, and she asked every girl she came across if she would like a kitten. At last she found a girl who was willing to take it, and she ran out of school feeling very happy.

18.—Johnny, aged four, and Harry, aged five, had been left at home with their sister, mother having gone out. When bedtime came they wanted to stay up for their mother, and it was hard work to get them to bed. Harry seemed indifferent, but Johnny cried loudly. Their sister listened at the bottom of the stairs, hoping that they would soon be good. At last Johnny stopped, and the listener heard him say, 'You cry a bit, Harry. I'm tired.'

19.—The chief use of the hump of the camel seems to lie in its power of nourishing the animal when other food is scarce. During a long desert journey, for example, the camels are very sparingly fed, and appear to subsist upon the nourishment derived from the hump, which gradually gets less, until at the end of the journey it is scarcely visible.

20.—[**H.M.I.'s TEST.**]—The mother worked hard all the day long to earn a scanty livelihood. She looked pale as she bent over her work, but she never complained, for she was thankful to have the work to do, and she wished for nothing better than to toil ceaselessly for her little girl, and take every care of her and make her happy.

21.—Onward, onward, may we press,
Through the path of duty;
Virtue is true happiness,
Excellence true beauty;
Minds are of celestial birth,
Make we, then, a heaven of earth.

PUPIL TEACHERS' EXAMINATION.—MODEL ANSWERS.

22nd OCTOBER, 1892.

FIRST YEAR.

BOYS ONLY.

Arithmetic.

1. A boy after losing first $\frac{2}{5}$ and afterwards $\frac{1}{9}$ of his original stock of marbles, found that he had 22 marbles left. How many had he at first?

Fraction of marbles lost $= \frac{2}{5} + \frac{1}{9} = \frac{18+5}{45} = \frac{23}{45}$

$\therefore$ " " remaining $= 1 - \frac{23}{45} = \frac{22}{45}$

but number of marbles remaining $= 22$

$\therefore \frac{22}{45}$ of marbles $= 22$

$\therefore \frac{1}{45}$ " $= 1$

$\therefore \frac{45}{45}$ " $= 45$ Ans.

or original number.

2. How many pieces each 3·06 inches long can be cut from a wire whose length is 54 inches; and what will be the length of the piece of wire remaining?

No. of pieces $= \frac{54}{3\cdot06} = \frac{5400}{306} = \frac{600}{34} = \frac{300}{17} = 17\frac{11}{17}$

$\therefore$ (*a*) Integral No. of pieces $= 17$ Ans.; and

(*b*) Length remaining $= \frac{11}{17}$ of 3·06 ins. $= \frac{11}{17}$ of $33\cdot66$ ins. $= 1\cdot98$ ins. Ans.

3. Simplify $\frac{(2\frac{1}{2} - \frac{1}{5}) \text{ of } (1\frac{1}{2} + \frac{4}{7})}{(\frac{5}{4} + \frac{1}{2}) \text{ of } \frac{2}{3} \div \frac{5}{3} \div 1\frac{1}{11}} =$

$$\frac{\left(\frac{5}{2} - \frac{1}{5}\right) \times \left(\frac{4}{3} + \frac{4}{7}\right)}{\frac{9+4}{12} \times \frac{5}{6} \times \frac{5}{3} \times \frac{12}{13}} = \frac{\frac{23}{10} \times \frac{40}{21}}{\frac{13}{12} \times \frac{12}{13} \times \frac{25}{18}} =$$

$$\frac{\frac{92}{21}}{\frac{25}{18}} = \frac{92}{21} \times \frac{18}{25} = \frac{552}{175} = 3\frac{27}{175} \text{ Ans.}$$

4. Compare the values of (*a*) $\frac{1}{2}(2\frac{1}{2} - \frac{3}{5})$; (*b*) $\frac{1}{2}$ of $(2\frac{1}{2} - \frac{3}{5})$; and (*c*) $2\frac{1}{2} - (\frac{1}{2}$ of $\frac{3}{5})$ =

(*a*) $\frac{1}{2}\left(\frac{5}{2} - \frac{3}{5}\right) = \frac{1}{2}\left(\frac{25-6}{10}\right) = \frac{1}{2} \times \frac{19}{10} = \frac{19}{30}$

(*b*) $\frac{1}{2}$ of $\left(\frac{5}{2} - \frac{3}{5}\right) = \frac{1}{2}\left(\frac{25-6}{10}\right)$ etc. as in (*a*)

(*c*) $\frac{5}{2} - \frac{1}{5} = \frac{25-2}{10} = \frac{23}{10} = \frac{69}{30}$

$\frac{10, 19, 69}{30}$ Ans.

5. Add together (*a*) 3·05 of 1s. 8d.; (*b*) 4·375 of £5 2s. 6d.; and (*c*) 7·08 of £1 17s. 6d.

(*a*) ·3·05 of 1s. 8d. $=$ 61d. $=$ 5s. 1d.

(*b*) 4·375 of £5 2s. 6d. $= 4\frac{3}{8}$ of £5 2s. 6d. $=$ £22 8s. $5\frac{1}{4}$d.

(*c*) 7·08 of £1 17s. 6d. $= 7\frac{2}{25}$ of £1 17s. 6d. $=$ £13 5s. 10d.

$\therefore$ Total $=$ 5s. 1d. + £22 8s. $5\frac{1}{4}$d. + £13 5s. 10d. $=$ £35 19s. $4\frac{1}{4}$d. Ans.

6. (*a*) Explain by reference to the corresponding vulgar fractions why ·307 is equal to ·30700. (*b*) In what other way can you explain this equality? (*c*) Why is it wrong to read ·307 as '*decimal three hundred and seven*'? (*d*) Find the value of ·749 of 1 ton 1 cwt. 1 qr.

(*a*) ·307 $= \frac{307}{1000}$ and ·30700 $= \frac{30700}{100000} = \frac{307}{1000}$ also.

Or thus:—

		tenths	hund'ths	thousandths	tens of thousandths	hundreds of thousandths
(*b*) ·307	=	3	0	7	0	0
·30700	=	3	0	7	0	0

(*c*) Because strictly speaking only ·3 is a decimal
whilst ·00 is a centesimal
and ·007 is a millesimal.

Also if we allow the term *decimal* to be generic, the order would not be similar to integers, but inverse, thus:—

Integers Decimals
Hundreds Tens Units — Tenths Hundredths Thousandths.

(*d*) ·749 $=$ ·75 $= \frac{3}{4}$.

Then $\frac{3}{4}$ of 1 ton 1 cwt. 1 qr. $= \frac{1}{4}$ of 3 tons 3 cwt. 3 qrs. $=$ 15 cwt. 3 qrs. 21 lbs. Ans.

GIRLS ONLY.

1. Find by Practice the cost of 13 miles 7 furls. 11 yards of railing, at £31 16s. 8d. per mile.

£31 16 8
13

		£413	16	8	Cost of 13 miles.			
4 furls. of 1 mile	$= \frac{1}{2}$	15	18	4	"	0	" 4 furls.	
2 " 4 furls.	$= \frac{1}{4}$	7	19	2	"	0	" 2 "	
1 " 2 "	$= \frac{1}{8}$	3	19	7	"	0	" 1 "	
11 yards of 1 "	$= \frac{1}{320}$	0	3	$11\frac{3}{4}$	"	0	" 0 "	11 yds.
Ans.		£441	17	$8\frac{3}{4}$	"	13	" 7 "	11 yds.

2. How many eggs at 2s. 11d. a score, can be bought for £7 13s. $1\frac{1}{2}$d.?

Cost per egg $= \frac{2s.\ 11d.}{20} = \frac{35d.}{20} = 1\frac{3}{4}$d.

$\therefore$ No. of eggs $= \frac{£7\ 13s.\ 1\frac{1}{2}d.}{1\frac{3}{4}d.} = \frac{7350 f.}{7 f.} = 1050$ eggs. Ans.

3. By how much is $\frac{1}{10} - \frac{1}{7} + \frac{3}{5} - \frac{1}{15}$ greater than $\frac{57}{240}$?

$$\left(\frac{1}{10} - \frac{1}{7} + \frac{3}{5} - \frac{1}{15}\right) - \frac{57}{240} = \frac{21 - 30 + 126 - 14}{210} - \frac{19}{80} =$$

$$\frac{103}{210} - \frac{19}{80} = \frac{824 - 399}{1680} = \frac{425}{1680} = \frac{85}{336} \text{ Ans.}$$

4. If a cwt. of coal cost 19s. 10d., what must be paid for 5 tons 19 cwt. 72 lbs.?

As 1 cwt. : 5 tons 19 cwt. 72 lbs :: 19s. 10d. : Ans.
112 lbs. : 13400 lbs. :: 238d. : Ans.
14 lbs. : 1675 lbs :: 238d. : Ans.
1 lb. : 1675 lbs. :: 17d. : Ans.

$\therefore$ 1675d. $\times$ 17 $=$ 28475d. $=$ 2372s. 11d. $=$ £118 12s. 11d. Ans.

5. Make out the following account:—

		£	s.	d.
23 oxen at £18 13s. 4d. each	=	429	6	8
145 sheep at £38 10s. per score	=	279	2	6
96 pigs at $5\frac{1}{2}$ guineas for six	=	92	8	0
45 fowls at 5s. 9d. per couple	=	6	9	$4\frac{1}{2}$
		£807	6	$6\frac{1}{2}$ Ans.

Describe *two* ways of working a simple subtraction sum, and explain each method fully.

6. Take the example 432 minus 198.

(*a*) *The method of decomposition.*

		H.	T.	U.
Minuend	432	3	12	12
Subtrahend	198	1	9	8
Diff.	234	2	3	4

As 8 cannot be taken from 2 in the units' place, and as 9 cannot be taken from 3 in the tens' place, we must take one ten from the 3 tens, and instead of 2 units have in the minuend 12 units, leaving only 2 tens there. But we must also transfer 1 hundred to the tens, making with the 2 tens 12 tens, and leaving but 3 hundreds, so that we have 432 $=$ 3 hundreds 12 tens 12 units, etc.

(*b*) *The method of equal addition.*

If to each of two numbers an equal amount be added, their difference is constant.

			H.	T.	U.
Minuend	432		4	13	12
Subtrahend	198	=	2	10	8
Diff.	234		2	3	4

Thus $(7-2)=17-12$, etc.

Thus as 8 cannot be taken from 4, nor 9 from 3, we add 10 to the Minuend making there 12 units, and also to the Subtrahend making there 10 tens.

And as 10 tens cannot be subtracted from 3 tens, we add 10 tens to the Minuend, making 13 tens and 10 tens (= one hundred) to the Subtrahend, making 2 hundreds, etc.

SECOND YEAR.

BOYS ONLY.

1. A landlord allowed to his tenants a reduction of 15 per cent. on their rental. What was the gross rental of a tenant whose reduced rent was £340?

Reduced Rental $= \frac{85}{100}$ of Gross Rental.

$\therefore$ Gross Rental $= \frac{100}{85}$ of Reduced Rental $= \frac{100}{85} \times £340 =$ £400. Ans.

2. A man bought stock at $97\frac{3}{8}$, and on its rising to $103\frac{3}{4}$, he sold out, making a profit of £107 5s.. How much stock did he buy? (Allow $\frac{1}{4}$ per cent. brokerage on each transaction.)

Actual cost of £100 stock $= £97\frac{3}{4}$.
Actual realised price of £100 stock $= £103\frac{1}{4}$.
$\therefore$ Profit on £100 stock $= £5\frac{1}{2}$.
$\therefore$ Stock to secure $£\frac{11}{2}$ profit $= £100$.
$\therefore$ Stock to secure £1 profit $= £100 \div \frac{11}{2} = £\frac{200}{11}$
$\therefore$ Stock to secure $£107\frac{1}{4}$ profit $= £\frac{200}{11} \times \frac{429}{4} = £50 \times 39$
$= £1{,}950$. Ans.

3. A money-lender charged £2 for a loan of £40 for a month. How much per cent. per annum was he charging?

£2 for £40 for a month =
£2 $\times \frac{5}{2}$ for £100 for a month =
£2 $\times \frac{5}{2} \times \frac{12}{1}$ for £100 for a year =
£60 for £100 for a year $\therefore$ Ans. = 60 per cent.

4. A cistern full of water lost ·07 of its contents by leakage, and then 301 gallons were drawn off, which left the cistern half-full. How many gallons did it contain?

·07 + 301 galls. + ·5 = 1 cistern
$\therefore$ ·57 + 301 galls. = 1 cistern
$\therefore$ 301 „ = 1 cistern − ·57 cistern = ·43 cisterns
$\therefore$ 30,100 „ = 43 cisterns
$\therefore$ Ans. 700 galls. = 1 cistern.

5. In how many years will £657 10s. produce £115 1s. 3d. as simple interest at $2\frac{1}{2}$ per cent. per annum?

$2\frac{1}{2}$ per cent. $= \frac{1}{40}$; $\therefore$ Interest on £657 10s. for 1 year $= \frac{£657\ 10s.}{40} = £16\ 8s.\ 9d.$

$\therefore$ No. of years $= \frac{£115\ 1s.\ 3d.}{£16\ 8s.\ 9d.} = \frac{1841}{263} =$ 7 years. Ans.

6. (A) Explain easy methods for effecting these calculations.

(*a*) 249 × 249; (*b*) 601 × 3s. 4d.; (*c*) 132 × $11\frac{3}{4}$d.

(*a*) $249 \times 249 = 249 \times 250 - 249 = 249000 \div 4 - 249 =$ 62250 − 249 = 62001 Ans.

(*b*) $601 \times 3s.\ 4d. = £601 \div 6 = £100\ 3s.\ 4d.$ Ans.

(*c*) $132 \times 11\frac{3}{4}d. = 132s. - 132$ farthings $= £6\ 12s.$ minus 2s. 9d. $= £6\ 9s.\ 3d.$ Ans.

or $132 \times 11\frac{3}{4}d. = 11 \times 11s.\ 9d. = £6\ 9s.\ 3d.$ Ans.

6. (B) What is the simple interest on £308 15s. for two years at $2\frac{1}{2}$ per cent. per annum?

Interest $= £308\ 15s.\ 0d. \times 2 \times \frac{5}{2} \times \frac{1}{100}$
$= £308\ 15s.\ 0d. \times \frac{1}{20}$
$= £15\ 8s.\ 9d.$ Ans.

GIRLS ONLY.

1. Reduce $\frac{3}{5}$ of 2 tons 5 cwts. 3 qrs. to the fraction of $\frac{3}{5}$ of $4\frac{1}{7}$ of 3 tons 8 cwts. 14 lbs. 14 ozs.

2 tons 5 cwts. 3 qrs. = 81984 ozs.; and 3 tons 8 cwts. 0 qrs. 14 lbs. 14 ozs. = 122094 ozs.

$$\frac{\frac{3}{5} \times 81984}{\frac{3}{5} \times \frac{29}{7} \times 122094} = \frac{5 \times 13664}{18 \times 17442} = \frac{5 \times 6832}{9 \times 17442} = \frac{5 \times 3416}{9 \times 8721} = \frac{17080}{78489}$$ Ans.

2. What decimal of £12 0s. 6d. is £1 2s. 9d.?

£12 0s. 6d. = 962 threepences.
£1 2s. 9d. = 91 threepences.

$\therefore$ fraction required $= \frac{91}{962} = \frac{7}{74} =$ ·09$\dot{4}\dot{5}$ Ans.

3. (*a*) One train travels $77\frac{1}{2}$ miles in 1 hour 27 minutes; (*b*) another, $105\frac{1}{2}$ miles in 2 hours 2 minutes; (*c*) and a third, $96\frac{1}{2}$ miles in 1 hour 55 minutes. Find the rate per hour in miles, of each train.

(*a*) $\frac{309}{4}$ miles in $\frac{87}{60}$ hours $= \frac{309}{4 \times 87}$ miles in $\frac{1}{60}$ hr. $= \frac{309 \times 60}{4 \times 87}$ miles in 1 hr. $= \frac{103 \times 15}{29}$ miles per hr. $= \frac{1545}{29}$ miles per hour $= 53\frac{8}{29}$ miles per hr. Ans.

(*b*) $\frac{211}{2}$ miles in $\frac{122}{60}$ hrs. $= \frac{211}{2 \times 122}$ miles in $\frac{1}{60}$ hr. $= \frac{211 \times 60}{2 \times 122}$ miles per hr. $= \frac{211 \times 15}{61}$ miles per hr. $= \frac{3165}{61}$ miles per hr. $= 51\frac{54}{61}$ miles per hr. Ans.

(*c*) $\frac{193}{2}$ miles in $\frac{115}{60}$ hr. $= \frac{193}{2 \times 115}$ miles in $\frac{1}{60}$ per hr. $= \frac{193 \times 60}{2 \times 115}$ miles per hr. $= \frac{193 \times 6}{23}$ miles per hr. $= \frac{1158}{23}$ miles per hr. $= 50\frac{8}{23}$ miles per hr. Ans.

4. (*a*) Find the L.C.M. of 132, 187, and 204; and (*b*) the G.C.M. of 6, 167, and 9691.

(*a*) $132 = 11 \times 3 \times 4$.
$187 = 11 \times 17$.
$204 = 17 \times 3 \times 4$.
$\therefore$ L.C.M. $= 11 \times 3 \times 4 \times 17 =$ 2244. Ans.

(*b*) $6167 = 881 \times 7$.
$9691 = 881 \times 11$.
Now 7 and 11 are prime numbers $\therefore$ 881 = G.C.M.

5. Simplify $\frac{7\frac{3}{17} + \frac{5}{17} + 3\frac{1}{3}\frac{5}{3} + \frac{1}{17} \text{ of } 25\frac{1}{2}}{5\frac{2}{3} - \frac{1}{4} + 6\frac{1}{2}} =$

$\frac{7\frac{1}{2} + 3\frac{1}{4} + 1\frac{1}{2}}{5\frac{5}{6} + 6\frac{1}{4}} = \frac{11\frac{3}{4} + \frac{1}{2}}{11\frac{7}{12} + \frac{1}{4}} = 11\frac{1}{4} \div 11\frac{1}{2} =$ 1. Ans.

6. How many quarters of oats at $11\frac{1}{2}$d. per peck are equal in value to 276 tons of coal at $9\frac{1}{2}$d. per cwt.?

Cost of coal $= 276 \times 20 \times \frac{19}{2}$d.
„ oats per quarter $= 4 \times 8 \times 2\frac{3}{4}$d.
$\therefore$ No. of quarters $= \frac{276 \times 10 \times 19}{4 \times 4 \times 23} = \frac{12 \times 10 \times 19}{4 \times 4} = \frac{3 \times 5 \times 19}{2} = \frac{285}{2} =$ 142½ quarters.

PUPIL TEACHERS' EXAMINATION.—MODEL ANSWERS.

22nd OCTOBER, 1892.

FIRST YEAR.

BOYS ONLY.

Arithmetic.

1. A boy after losing first $\frac{2}{5}$ and afterwards $\frac{1}{9}$ of his original stock of marbles, found that he had 22 marbles left. How many had he at first?

Fraction of marbles lost $= \frac{2}{5} + \frac{1}{9} = \frac{18+5}{45} = \frac{23}{45}$

$\therefore$ " " remaining $= 1 - \frac{23}{45} = \frac{22}{45}$

but number of marbles remaining $= 22$

$\therefore \frac{22}{45}$ of marbles $= 22$

$\therefore \frac{1}{45}$ " $= 1$

$\therefore \frac{45}{45}$ " $\Big\}$ $= 45$ Ans.

or original number.

2. How many pieces each 3·06 inches long can be cut from a wire whose length is 54 inches; and what will be the length of the piece of wire remaining?

No. of pieces $= \frac{54}{3{\cdot}06} = \frac{5400}{306} = \frac{600}{34} = \frac{300}{17} = 17\frac{11}{17}$

$\therefore$ (*a*) Integral No. of pieces $= \underline{17}$ Ans.; and

(*b*) Length remaining $= \frac{11}{17}$ of 3·06 ins. $= \frac{11}{17}$ of 33·66 ins. $= \underline{1{\cdot}98 \text{ ins.}}$ Ans.

3. Simplify $\frac{(2\frac{1}{2} - \frac{1}{5}) \text{ of } (1\frac{1}{2} + \frac{4}{7})}{(\frac{3}{4} + \frac{1}{3}) \text{ of } \frac{1}{2} \div \frac{3}{5} \div 1\frac{3}{14}} =$

$$\frac{\left(\frac{5}{2} - \frac{1}{5}\right) \times \left(\frac{4}{3} + \frac{4}{7}\right)}{\frac{9+4}{12} \times \frac{5}{6} \times \frac{5}{3} \times \frac{12}{13}} = \frac{\frac{23}{10} \times \frac{40}{21}}{\frac{13}{12} \times \frac{12}{13} \times \frac{25}{18}} =$$

$$\frac{\frac{92}{21}}{\frac{25}{18}} = \frac{92}{21} \times \frac{18}{25} = \frac{552}{175} = \underline{3\tfrac{27}{175}} \text{ Ans.}$$

4. Compare the values of (*a*) $\frac{1}{3}$ of $(2\frac{1}{2} - \frac{3}{5})$; (*b*) $\frac{1}{3}$ of $(2\frac{1}{2} - \frac{3}{5})$; and (*c*) $2\frac{1}{2} - (\frac{1}{3}$ of $\frac{3}{5}) =$

(*a*)	(*b*)	(*c*)
$\frac{1}{3}\left(\frac{5}{2} - \frac{3}{5}\right) =$	$\frac{1}{3}$ of $\left(\frac{5}{2} - \frac{3}{5}\right) =$	$\frac{5}{2} - \frac{1}{5} =$
$\frac{1}{3}\left(\frac{25-6}{10}\right) =$	$\frac{1}{3}\left(\frac{25-6}{10}\right)$ etc.	$\frac{25-2}{10} =$
$\frac{1}{3} \times \frac{19}{10} =$	as in (*a*)	$\frac{23}{10} =$
$\frac{19}{30}$		$\frac{69}{30}$
		$\frac{10, 19, 69}{30}$ Ans.

5. Add together (*a*) 3·05 of 1s. 8d.; (*b*) 4·375 of £5 2s. 6d.; and (*c*) 7·08 of £1 17s. 6d.

(*a*) ·3·05 of 1s. 8d. $=$ 61d. $=$ 5s. 1d.

(*b*) 4·375 of £5 2s. 6d. $= 4\frac{3}{8}$ of £5 2s. 6d. $=$ £22 8s. $5\frac{1}{4}$d.

(*c*) 7·08 of £1 17s. 6d. $= 7\frac{2}{25}$ of £1 17s. 6d. $=$ £13 5s. 10d.

$\therefore$ Total $=$ 5s. 1d. + £22 8s. $5\frac{1}{4}$d. + £13 5s. 10d. $=$ $\underline{\text{£35 19s. } 4\frac{1}{4}\text{d.}}$ Ans.

6. (*a*) Explain by reference to the corresponding vulgar fractions why ·307 is equal to ·30700. (*b*) In what other way can you explain this equality? (*c*) Why is it wrong to read ·307 as '*decimal three hundred and seven*?' (*d*) Find the value of ·749 of 1 ton 1 cwt. 1 qr.

(*a*) ·307 $= \frac{307}{1000}$ and ·30700 $= \frac{30700}{100000} = \frac{307}{1000}$ also.

Or thus:—

	tenths	hund'ths	thousandths	tens of thousandths	hundreds of thousandths
(*b*) ·307 $=$	3	0	7	0	0
·30700 $=$	3	0	7	0	0

(*c*) Because strictly speaking only ·3 is a decimal
whilst ·00 is a centesimal
and ·007 is a millesimal.

Also if we allow the term *decimal* to be generic, the order would not be similar to integers, but inverse, thus:—

Integers Decimals
Hundreds Tens Units — Tenths Hundredths Thousandths.

(*d*) ·749 $=$ ·75 $= \frac{3}{4}$.

Then $\frac{3}{4}$ of 1 ton 1 cwt. 1 qr. $= \frac{1}{4}$ of 3 tons 3 cwt. 3 qrs. $=$ $\underline{\text{15 cwt. 3 qrs. 21 lbs.}}$ Ans.

GIRLS ONLY.

1. Find by Practice the cost of 13 miles 7 furls. 11 yards of railing, at £31 16s. 8d. per mile.

£31 16 8

13

	£413	16	8	Cost of 13 miles.
4 furls. of 1 mile $= \frac{1}{2}$	15	18	4	" 0 " 4 furls.
2 " 4 furls. $= \frac{1}{2}$	7	19	2	" 0 " 2 "
1 " 2 " $= \frac{1}{2}$	3	19	7	" 0 " 1 "
11 yards of 1 " $= \frac{1}{20}$	0	3	$11\frac{2}{3}$	" 0 " 0 " 11 yds.
Ans.	£441	17	$8\frac{1}{3}$	" 13 " 7 " 11 yds.

2. How many eggs at 2s. 11d. a score, can be bought for £7 13s. $1\frac{1}{2}$d.?

Cost per egg $= \frac{2\text{s. } 11\text{d.}}{20} = \frac{35\text{d.}}{20} = 1\frac{3}{4}\text{d.}$

$\therefore$ No. of eggs $= \frac{\text{£7 13s. } 1\frac{1}{2}\text{d.}}{1\frac{3}{4}\text{d.}} = \frac{7350\text{f.}}{7\text{f.}} = \underline{1050 \text{ eggs.}}$ Ans.

3. By how much is $\frac{1}{10} - \frac{1}{7} + \frac{3}{5} - \frac{1}{15}$ greater than $\frac{57}{240}$?

$$\left(\frac{1}{10} - \frac{1}{7} + \frac{3}{5} - \frac{1}{15}\right) - \frac{57}{240} = \frac{21 - 30 + 126 - 14}{210} - \frac{19}{80} =$$

$$\frac{103}{210} - \frac{19}{80} = \frac{824 - 399}{1680} = \frac{425}{1680} = \frac{85}{336} \quad \text{Ans.}$$

4. If a cwt. of coal cost 19s. 10d., what must be paid for 5 tons 19 cwt. 72 lbs.?

As 1 cwt. : 5 tons 19 cwt. 72 lbs :: 19s. 10d. : Ans.
112 lbs. : 13400 lbs. :: 238d. : Ans.
14 lbs. : 1675 lbs. :: 238d. : Ans.
1 lb. : 1675 lbs. :: 17d. : Ans.

$\therefore$ 1675d. $\times$ 17 $=$ 28475d. $=$ 2372s. 11d. $=$ $\underline{\text{£118 12s. 11d.}}$ Ans.

5. Make out the following account:—

	£	s.	d.
23 oxen at £18 13s. 4d. each $=$	429	6	8
145 sheep at £38 10s. per score $=$	279	2	6
96 pigs at $5\frac{1}{2}$ guineas for six $=$	92	8	0
45 fowls at 5s. 9d. per couple $=$	6	9	$4\frac{1}{2}$
	£807	6	$6\frac{1}{2}$ Ans.

Describe *two* ways of working a simple subtraction sum, and explain each method fully.

6. Take the example 432 minus 198.

(*a*) *The method of decomposition.*

		H.	T.	U.
Minuend	432	3	12	12
Subtrahend	198	1	9	8
Diff.	234	2	3	4

As 8 cannot be taken from 2 in the units' place, and as 9 cannot be taken from 3 in the tens' place, we must take one ten from the 3 tens, and instead of 2 units have in the minuend 12 units, leaving only 2 tens there. But we must also transfer 1 hundred to the tens, making with the 2 tens 12 tens, and leaving but 3 hundreds, so that we have 432 $=$ 3 hundreds 12 tens 12 units, etc.

(*b*) *The method of equal addition.*

If to each of two numbers an equal amount be added, their difference is constant.

		H.	T.	U.
Minuend	432	4	13	12
Subtrahend	198	2	10	8
Diff.	234	2	3	4

Thus (7 — 2) = 17 — 12, etc.

Thus as 8 cannot be taken from 4, nor 9 from 3, we add 10 to the Minuend making there 12 units, and also to the Subtrahend making there 10 tens.

And as 10 tens cannot be subtracted from 3 tens, we add 10 tens to the Minuend, making 13 tens and 10 tens (= one hundred) to the Subtrahend, making 2 hundreds, etc.

SECOND YEAR.

BOYS ONLY.

1. A landlord allowed to his tenants a reduction of 15 per cent. on their rental. What was the gross rental of a tenant whose reduced rent was £340?

Reduced Rental = $\frac{85}{100}$ of Gross Rental.

∴ Gross Rental = $\frac{100}{85}$ of Reduced Rental = $\frac{100}{85} \times £340 =$ £400. Ans.

2. A man bought stock at 97$\frac{3}{8}$, and on its rising to 103$\frac{1}{2}$, he sold out, making a profit of £107 5s.. How much stock did he buy? (Allow $\frac{1}{8}$ per cent. brokerage on each transaction.)

Actual cost of £100 stock = £97$\frac{3}{4}$.
Actual realised price of £100 stock = £103$\frac{1}{4}$.
∴ Profit on £100 stock = £5$\frac{1}{4}$.
∴ Stock to secure £$\frac{11}{2}$ profit = £100.
∴ Stock to secure £1 profit = £100 ÷ $\frac{11}{2}$ = £$\frac{200}{11}$
∴ Stock to secure £107$\frac{1}{4}$ profit = £$\frac{200}{11} \times \frac{429}{4}$ = £50 × 39 = £1,950. Ans.

3. A money-lender charged £2 for a loan of £40 for a month. How much per cent. per annum was he charging?

£2 for £40 for a month =
£2 × $\frac{5}{2}$ for £100 for a month =
£2 × $\frac{5}{2}$ × $\frac{12}{1}$ for £100 for a year =
£60 for £100 for a year ∴ Ans. = 60 per cent.

4. A cistern full of water lost ·07 of its contents by leakage, and then 301 gallons were drawn off, which left the cistern half-full. How many gallons did it contain?

·07 + 301 galls. + ·5 = 1 cistern
∴ ·57 + 301 galls. = 1 cistern
∴ 301 „ = 1 cistern — ·57 cistern = ·43 cisterns
∴ 30,100 „ = 43 cisterns
∴ Ans. 700 galls. = 1 cistern.

5. In how many years will £657 10s. produce £115 1s. 3d. as simple interest at 2$\frac{1}{2}$ per cent. per annum?

2$\frac{1}{2}$ per cent. = $\frac{1}{40}$; ∴ Interest on £657 10s. for 1 year = $\frac{£657\ 10s.}{40}$ = £16 8s. 9d.

∴ No. of years = $\frac{£115\ 1s.\ 3d.}{£16\ 8s.\ 9d.} = \frac{1841}{263}$ = 7 years. Ans.

6. (A) Explain easy methods for effecting these calculations.

(*a*) 249 × 249; (*b*) 601 × 3s. 4d.; (*c*) 132 × 11$\frac{3}{4}$d.

(*a*) 249 × 249 = 249 × 250 — 249 = 249000 ÷ 4 — 249 = 62250 — 249 = 62001 Ans.

(*b*) 601 × 3s. 4d. = £601 ÷ 6 = £100 3s. 4d. Ans.

(*c*) 132 × 11$\frac{3}{4}$d. = 132s. — 132 farthings = £6 12s. minus 2s. 9d. = £6 9s. 3d. Ans.

or 132 × 11$\frac{3}{4}$d. = 11 × 11s. 9d. = £6 9s. 3d. Ans.

6. (B) What is the simple interest on £308 15s. for two years at 2$\frac{1}{2}$ per cent. per annum?

Interest = £308 15s. 0d. × 2 × $\frac{5}{2}$ × $\frac{1}{100}$
= £308 15s. 0d. × $\frac{1}{20}$
= £15 8s. 9d. Ans.

GIRLS ONLY.

1. Reduce $\frac{5}{6}$ of 2 tons 5 cwts. 3 qrs. to the fraction of $\frac{3}{5}$ of 4$\frac{4}{7}$ of 3 tons 8 cwts. 14 lbs. 14 ozs.

2 tons 5 cwts. 3 qrs. = 81984 ozs.; and 3 tons 8 cwts. 0 qrs. 14 lbs. 14 ozs. = 122094 ozs.

$\frac{\frac{5}{6} \times 81984}{\frac{3}{5} \times \frac{30}{7} \times 122094} = \frac{5 \times 13664}{18 \times 17442} = \frac{5 \times 6832}{9 \times 17442} = \frac{5 \times 3416}{9 \times 8721} = \frac{17080}{78489}$ Ans.

2. What decimal of £12 0s. 6d. is £1 2s. 9d.?

£12 0s. 6d. = 962 threepences.
£1 2s. 9d. = 91 threepences.
∴ fraction required = $\frac{91}{962} = \frac{7}{74}$ = ·094$\frac{5}{37}$ Ans.

3. (*a*) One train travels 77$\frac{1}{2}$ miles in 1 hour 27 minutes; (*b*) another, 105$\frac{1}{2}$ miles in 2 hours 2 minutes; (*c*) and a third, 96$\frac{1}{2}$ miles in 1 hour 55 minutes. Find the rate per hour in miles, of each train.

(*a*) $\frac{309}{4}$ miles in $\frac{87}{60}$ hours = $\frac{309}{4 \times 87}$ miles in $\frac{1}{60}$ hr. = $\frac{309 \times 60}{4 \times 87}$ miles in 1 hr. = $\frac{103 \times 15}{29}$ miles per hr. = $\frac{1545}{29}$ miles per hour = 53$\frac{8}{29}$ miles per hr. Ans.

(*b*) $\frac{211}{2}$ miles in $\frac{122}{60}$ hrs. = $\frac{211}{2 \times 122}$ miles in $\frac{1}{60}$ hr. = $\frac{211 \times 60}{2 \times 122}$ miles per hr. = $\frac{211 \times 15}{61}$ miles per hr. = $\frac{3165}{61}$ miles per hr. = 51$\frac{54}{61}$ miles per hr. Ans.

(*c*) $\frac{193}{2}$ miles in $\frac{115}{60}$ hr. = $\frac{193}{2 \times 115}$ miles in $\frac{1}{60}$ per hr. = $\frac{193 \times 60}{2 \times 115}$ miles per hr. = $\frac{193 \times 6}{23}$ miles per hr. = $\frac{1158}{23}$ miles per hr. = 50$\frac{8}{23}$ miles per hr. Ans.

4. (*a*) Find the L.C.M. of 132, 187, and 204; and (*b*) the G.C.M. of 6, 167, and 9691.

(*a*) 132 = 11 × 3 × 4.
187 = 11 × 17.
204 = 17 × 3 × 4.
∴ L.C.M. = 11 × 3 × 4 × 17 = 2244. Ans.

(*b*) 6167 = 881 × 7.
9691 = 881 × 11.
Now 7 and 11 are prime numbers ∴ 881 = G.C.M.

5. Simplify $\frac{7\frac{3}{17} + \frac{5}{7 \times 2} + 3\frac{1}{7}\frac{5}{2} + \frac{1}{7}\frac{1}{7}\text{ of }25\frac{1}{2}}{5\frac{3}{8} - \frac{1}{4} + 6\frac{1}{2}}$ =

$\frac{7\frac{1}{8} + 3\frac{1}{4} + 1\frac{1}{2}}{5\frac{3}{8} + 6\frac{1}{4}} = \frac{11\frac{3}{8} + \frac{1}{4}}{11\frac{5}{8} + \frac{1}{4}} = 11\frac{1}{16} \div 11\frac{1}{2} =$ 1. Ans.

6. How many quarters of oats at 11$\frac{1}{2}$d. per peck are equal in value to 276 tons of coal at 9$\frac{1}{2}$d. per cwt.?

Cost of coal = 276 × 20 × $\frac{19}{2}$d.
„ oats per quarter = 4 × 8 × $\frac{23}{2}$d.
∴ No. of quarters = $\frac{276 \times 10 \times 19}{4 \times 4 \times 23} = \frac{12 \times 10 \times 19}{4 \times 4} = \frac{3 \times 5 \times 19}{2} = \frac{285}{2}$ = 142$\frac{1}{2}$ quarters.

THIRD YEAR.

BOYS ONLY.

1. (*a*) Simplify

$$\frac{2\frac{1}{2}}{5\frac{1}{2} + \frac{1}{3 + \frac{2}{5 - 3\frac{1}{2}}}} =$$

$$\frac{\frac{5}{2}}{\frac{11}{2} + \frac{1}{3 + \frac{2}{5 - \frac{11}{4}}}} = \frac{\frac{5}{2}}{\frac{11}{2} + \frac{1}{3 + \frac{2}{\frac{9}{4}}}} = \frac{\frac{5}{2}}{\frac{11}{2} + \frac{1}{3 + \frac{8}{9}}} =$$

$$\frac{\frac{5}{2}}{\frac{11}{2} + \frac{9}{35}} = \frac{\frac{5}{2}}{\frac{404}{70}} = \frac{5}{2} \times \frac{70}{404} = \frac{175}{202}$$ Ans.

(*b*) Reduce ·06$\dot{2}\dot{5}$ of £990 to the decimal of £100.

$$\cdot 06\dot{2}\dot{5} = \frac{625 - 6}{9900} = \frac{619}{9900}$$

And $\frac{619}{9900} \times £990 = £61{\cdot}9$

$\therefore$ Required decimal $= \frac{61{\cdot}9}{100} =$ ·619. Ans.

2. In what ratio must two kinds of tea, costing respectively 1s. 3d. and 2s. 2d. per lb. be mixed so that the mixture may cost 1s. 6d. per lb. ?

Loss on each lb. at 2s. 2d. = 8d.
Gain " " " " 1s. 3d. = 3d.

$\therefore$ to equalise, the quantities must be in inverse ratio of the ratio of the gains (*i.e.* gain and loss).

viz., 3 at 2s. 2d. for every 8 at 1s. 3d. Ans.

3. In a 200 yards race A can give B 10 yards start, and *just* win ; and B can give C 20 yards start. How much start could A give C ?

(1) B runs 190 yards while A runs 200 yards.
(2) C " 180 " " B " 200 "
$\therefore$ C " 171 " " B " 190 "
$\therefore$ C " 171 " " A " 200 "
$\therefore$ A can give C = 29 yards. Ans.

4. A beam, 18 feet long, whose transverse section is a square, contains 200 cubic feet of timber. What is its breadth ?

L × A = C where L = length, A = area of tranverse section, and C = solid content.

$\therefore 18 \times A = 200$; $\therefore A = \frac{200}{18} = \frac{100}{9}$

But A = the square of the breadth.

$\therefore$ Breadth $= \sqrt{\frac{100}{9}} = \frac{10}{3}$ feet $= 3\frac{1}{3}$ feet Ans.

5. A company pays a dividend of 9 per cent. ; and its £10 shares sell for £25. What per centage will an investor get for his money ?

Interest on £25 $= \frac{9}{100}$ of £10 = 18s.
$\therefore$ " " £100 = £3 12s.

3$\frac{3}{5}$ per cent. Ans.

6. (*a*) Show that the value of a fraction is not altered by multiplying numerator and denominator by the same number.

First. A Vulgar Fraction may be regarded as a ratio ; and the value of any ratio remains unaltered when its antecedent and consequent are increased the same number of times. Thus $\frac{3}{4} = \frac{9}{12}$ for As 3 : 4 :: 9 : 12.

Second. A Vulgar Fraction may be regarded as concrete. Thus $\frac{3}{4}$ is 3 fourths, but by the principle of Reduction, if we change the fourths into twelfths, we must have 9 twelfths to = 3 fourths.

Third. A Vulgar Fraction may be regarded as a Quotient, the Numerator being the Dividend, and the Denominator the Divisor.

Thus $\frac{3}{4} = 4)\ 3\ (\frac{3}{4}$

Now, if we multiply the Divisor and Dividend by the same number the Quotient remains the same.

(*b*) 238·9$\dot{3}$ ÷ 75 = 79·6$\dot{4}$ ÷ 25 = 15·9$\dot{2}$ ÷ 5 = 3·18$\dot{4}$. Ans.

(*c*) 11·8$\dot{9}$6 + 1·418$\dot{5}$.

11·896896896896 . . . .
1·4185185185185 . . . .
13·31541541541153 . . . .

$\therefore$ Ans. = 13·315$\frac{4}{13}$.

N.B.—The above are to be worked without using Vulgars.

GIRLS ONLY.

1. What must be paid for 37 miles 5 furlongs 28 poles at 1s. 11½d. for 11 yards ?

37 miles 5 furlongs 28 poles = 6034 eleven yards.

The problem now is : 'Cost of 6034 articles at 1s. 11½d. each.'

	£	s.	d.	
	6034	0	0	
2s. of £1 = $\frac{1}{10}$	603	8	0	= Cost at 2s. each.
½d. of 2s. = $\frac{1}{48}$	12	11	5	(minus) Cost at ½d. each.
£	590	16s.	7d.	= Cost at 1s. 11½d. each. Ans.

2. A bicycle wheel is 3·625 yards in circumference and travels at the rate of 10·875 miles an hour. How many times will it revolve in a minute ?

Rate in yards per minute $= \frac{10{\cdot}875 \times 1760}{60} = 3{\cdot}625 \times 88.$

$\therefore$ Number of revolutions $= \frac{3{\cdot}625 \times 88}{3{\cdot}625} =$ 88. Ans.

3. A can do a piece of work in 8, B in 10, and C in 12 days. A, B, and C all start upon the work together. B works 2 and C works 3 days. In how many days after C has left will A finish it ?

A in 1 day can do $\frac{1}{8}$
B " " " $\frac{1}{10}$
C " " " $\frac{1}{12}$

$\therefore$ In first 3 days A does $\frac{3}{8}$, B does $\frac{1}{5}$, and C does $\frac{1}{4} = \frac{15 + 8 + 10}{40} = \frac{33}{40}$ and leaving $\frac{7}{40}$ to be done.

Now time required by A to do $\frac{1}{8}$ or $\frac{5}{40} = 1$ day
$\therefore$ " " " " $\frac{1}{40} = \frac{1}{5}$ day
$\therefore$ " " " " $\frac{7}{40} = \frac{7}{5}$ days
$= 1\frac{2}{5}$ days. Ans.

4. If I pay £3·19375 for 3·041$\dot{6}$ cwts. of sugar, how much is that for a pound ?

Cost per lb. $= \frac{£3{\cdot}19375}{3{\cdot}0416 \times 112} = \frac{£3{\cdot}19375}{340{\cdot}\dot{6}} = £3\frac{31}{160} \div 340\frac{2}{3} =$

$\frac{511}{160} \times \frac{3}{1022} \times \frac{240}{1}$ d. $= \frac{3 \times 3}{2 \times 2}$ d. $= \frac{9}{4}$ d. $= 2\frac{1}{4}$d. Ans.

5. The floor of a room is 21 feet 6 inches long, and 15 feet 9 inches broad. Find the cost of covering it with carpet, 27 inches wide, at 3s. 9d. per yard.

Area $= 21\frac{1}{2} \times 15\frac{3}{4}$ sq. ft. $= \frac{43}{2} \times \frac{63}{4}$ sq. ft.

Length of carpet in ft. = Area ÷ Width $= \frac{43}{2} \times \frac{63}{4} \div 2\frac{1}{4}$ ft. =

$\frac{43}{2} \times \frac{63}{4} \times \frac{4}{9}$ ft. $= \frac{43 \times 7}{2}$ ft. $= \frac{161}{2}$ ft.

Cost of carpet per yd. = 3s. 9d.
" " " ft. = 1s. 3d. = £$\frac{1}{16}$.
" $\frac{161}{2}$ ft. of carpet = £$\frac{1}{16} \times \frac{161}{2} =$ £161 ÷ 32 =
£5 0s. 7½d. Ans.

6. (*a*) Illustrate the principle of proportion by concrete examples rather than by abstract definition, *e.g.*, if of 56 marbles a lad may select 3 out of every 4, or 6 out of every 8 he gets the same number. Thus the ratio obtained is the same, *i.e.*, 3 out of 4 = 6 out of 8, which is expressed thus : As 3 : 4 :: 6 : 8.

(*b*) Next explain more scientifically the term ratio, and show that it

(i.) Must consist of two terms or there would be no comparison.

(ii.) Must obtain between terms of *the same kind.*

(*c*) Four terms (either expressed or understood) are required for a proportion, because the same ratio is expressed by different figures at least twice. Thus proportion is the equality of ratios.

(*d*) Extending the examples, it may be shown from actual facts, that if the two terms of a ratio are multiplied (or divided) by the same integral or fractional number, the ratio is not altered.

(*e*) Show that when four quantities are in proportion, the product of the *extremes* equals the product of the *means*, *e.g.*, if 3 : 4 :: 6 : 8, then 3 × 8 = 6 × 4.

This is quite sufficient for one and the first lesson.

THIRD YEAR.

BOYS ONLY.

Algebra.

1. Prove that if from the fourth power of the sum of any two numbers be taken the sum of their fourth powers, the remainder is always divisible by the twice the sum of their squares added to three times their product.

Let x and y = the two numbers.

Then $(x + y)$ = their sum.

Then $(x + y)^4 = x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$ = fourth power of their sum.

Then $x^4 + y^4$ = sum of their fourth powers.

Then $2x^2 + 2y^2$ = twice the sum of their squares.

Then $3xy$ = three times their product.

It is required to show that—

$\frac{x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4 - x^4 - y^4}{2x^2 + 2y^2 + 3xy}$ leaves no remainder.

Proof—

$$\frac{4x^3y + 6x^2y^2 + 4xy^3}{2x^2 + 2y^2 + 3xy} = \frac{2xy(2x^2 + 3xy + 2y^2)}{2x^2 + 3xy + 2y^2} = 2xy. \quad \text{Q.E.D.}$$

2. (*a*) Show how the G.C.M. of three expressions may be found.

By finding the G.C.M. of any two, and next the G.C.M. of the first G.C.M., and the third expression.

(*b*) Find the G.C.M. of—

i. $2x^4 - x^3 - 2x^2 + 3x - 1 = (2x - 1)(x^3 - x + 1)$

ii. $2x^4 - x^3 + 2x^2 - 3x + 1 = (2x - 1)(x^3 + x - 1)$

iii. $(2x - 1)(x^3 + x + 1) = (2x - 1)(x^3 + x + 1)$

Now $x^3 - x + 1$; $x^3 + x - 1$; $x^3 + x + 1$ are prime factors.

$\therefore 2x - 1$ = Ans.

3. (*a*) Prove that $a^{4m} \div a^m = a^{3m}$.

$$\frac{a^{4m}}{a^m} = \frac{a^m \times a^m \times a^m \times a^m}{a^m} = a^m \times a^m \times a^m = a^{3m}$$

3. (*b*) Find the value of $\frac{x}{b-a} + \frac{x}{a} - \frac{a}{a+b}$ when $x = \frac{a^2(b-a)}{b(b+a)}$

$$\frac{x}{b-a} + \frac{x}{a} - \frac{a}{a+b} = \frac{a^2(b-a)}{(b-a)(b+a)b} + \frac{a^2(b-a)}{ab(b+a)} -$$

$$\frac{a}{a+b} = \frac{a^3(b-a) + a^2(b-a)^2 - a^2b(b-a)}{ab(b+a)(b-a)} -$$

$$\frac{a^3b - a^4 + a^4 - 2a^3b + a^2b^2 - a^2b^2 + a^3b}{ab(b+a)(b-a)}$$

$= 0$ Ans.

4. Solve the equations :—

(*a*) $3x - [4 - \{5x - (2x - 1)\} - 6] = 9$

(*b*) $\frac{4}{10+x} + \frac{10}{6-5x} + \frac{6}{2-3x} = 0$

(*a*) $3x - \{4 - (5x - 2x + 1) - 6\} = 9$

$3x - (4 - 5x + 2x - 1 - 6) = 9$

$3x - 4 + 5x - 2x + 1 + 6 = 9$

$6x + 3 = 9$

$x = 1$ Ans.

(*b*) $\frac{2}{10+x} + \frac{5}{6-5x} + \frac{3}{2-3x} = 0$

$$\frac{30x^2 - 56x + 24 - 15x^2 - 140x + 100 - 15x^2 - 132x + 180}{(10+x)(6-5x)(2-3x)} = 0$$

$-328x = -304$

$x = \frac{304}{328} = \frac{38}{41}$ Ans.

Euclid.

SECOND YEAR.

BOYS ONLY.

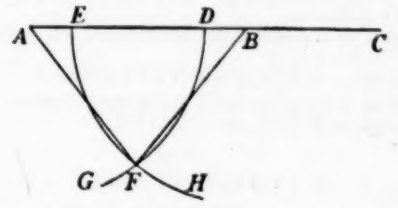
1. (*a*) Define *right angle*. (*b*) The angles which one straight line makes with another on one side of it, are either two right angles or are together equal to two right angles.

See (*a*) Definition 2, (*b*) Prop. XIII., Book I.

2. (*a*) Define *Scalene triangle*. (*b*) If from the ends of a side of a triangle there be drawn two straight lines to a point within the triangle, these shall be less than the triangle, but shall contain a greater angle.

See (*a*) Definition 24, (*b*) Prop. XXI., Book I.

3. Given two straight lines, describe on one of them as base an isosceles triangle, the sum of whose sides shall be equal to the sum of the two given lines.



Let AB and BC be the two given straight lines so placed as to form one straight line AC.

Construction—

Bisect AC in D. (Prop. X.) Make BE = AD (Prop. II.)

From A with distance AD describe circle DFG, and from B with distance BE describe circle EFH, and from F one of the points in which the circles cut each other, draw EF and DF.

Then DEF is the required triangle.

Proof—

∵ A is centre of circle DFG, ∴ AD = AF.

∵ B " EFH, ∴ BE = BF; but BE was made = to AD, ∴ BF = " AD = AF.

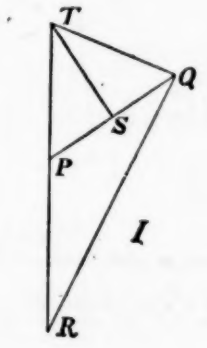
∴ AFB is an isosceles triangle, and AF = AD, and BF = DC.

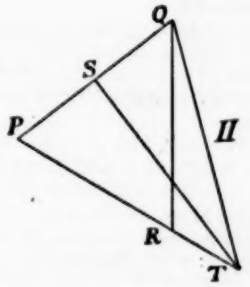
∴ AF together with FB = AC = AB together with BC.

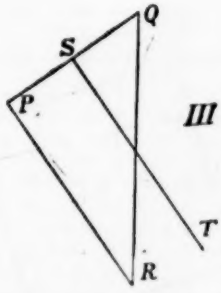
Q.E.F.

4. Given the triangle PQR; to describe a circle which shall pass through the points PQ, and have its centre in PR on PR produced. Is this always possible?

Construction—







Bisect PQ in S. Draw ST at right angles to PQ and meeting PR, or PR produced in T. Then T is the centre of the required circle.

Proof—

Join TQ.

∴ PS, ST and ∧ PST = respectively QS, ST, and ∧ QST, then (by I. 4.) TP = TQ, and a circle described from T with TP as radius will pass through Q. Q.E.F.

Notes—

(*a*) If QPR be a right angle, then ST is parallel to PR (I. 28.) Fig. III., *and the problem is impossible.*

(*b*) If SPR be an acute angle, then T and R will be on the same side of PQ (Axiom 12.)

(*c*) If SPR be an obtuse angle, then T and R will be on opposite sides of PQ (Axiom 12.)

(*d*) If PQR be < QPR, then T is in PR produced.

(*e*) If PQR be = QPR, then T and R are coincident.

(*f*) If PQR be > QPR, then T is in PR.

THIRD YEAR.

BOYS ONLY.

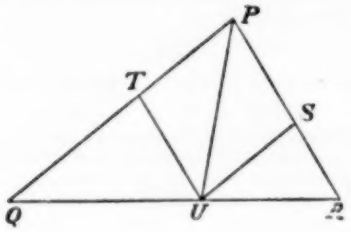
1. (*a*) Define *parallel straight lines.* (*b*) If a straight line falling on two other straight lines make the alternate angles equal to one another, these two straight lines shall be parallel.

See (*a*) Definition 28; (*b*) Prop. I. 27.

2. (*a*) Define *parallelogram.* (*b*) To describe a parallelogram that shall be equal to a given triangle, and have one of its angles equal to a given angle.

See (*a*) Definition 30; (*b*) Prop. I. 42.

3. Given the triangle PQR, find a point in QR from which lines drawn parallel to PQ, PR, and meeting them are equal.



Construction—

Bisect ∧ QPR by line PU, meeting QR in U.

Then U is the required point.

Draw US parallel to QP, and meeting PR in S.

Draw UT parallel to RP, and meeting QP in T.

Proof—

∧ TPU = ∧ SUP (I. 29.)

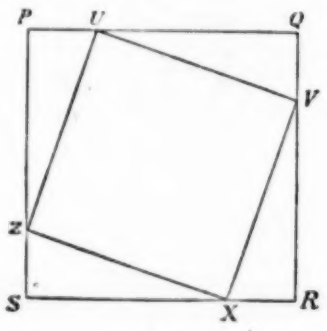
But ∧ TPU = ∧ SPU (Construction).

∴ ∧ SUP = SPU (Axiom) I.

∴ side SP = side SU (I. 6.) Q.E.F.

NOTE the careless language of the question 'lines drawn *parallel* to PQ, PR, and *meeting* them.'

4. The points U, V, X, Z, are taken in PQ, QR, RS, SP, the four sides of a square, so that PU, QV, RX, SZ are equal each to each. Show that the figure formed by joining the points so taken is a square.



Proof—

From the equals PQ, QR, RS, SP take respectively the equals PU, QV, RX, SZ; then the remainders UQ, VR, XS, and ZP are = (Axiom 3).

∴ ZP, PU, ∧ ZPU = UQ, QV, ∧ UQV = VR, RX, ∧ VRX = XS, SZ, ∧ XSZ respectively. ∴ ZU = UV = VX = XZ.

Also ∧s PUZ and QUV = ∧s QVU and RVX = ∧s RXV and ZXS = ∧s SZX and UZP.

∴ ∧s ZUV, UVX, VXZ, XZU are = (I. 13).

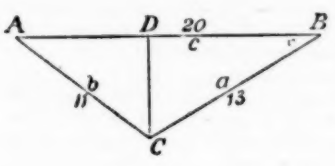
∴ ∧s ZUV, UVX, VXZ, XZU are right angles (I. 32, Coroll. 1.)

Mensuration.

THIRD YEAR.

BOYS ONLY.

1. The sides of a triangular field are respectively 11, 13. 20 chains. Find (*a*) the acreage of the field, and (*b*) the perpendicular distance of the longest side from the opposite corner.



(*a*) Area = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$ where s = half the sum of the sides and a, b, c = the sides. Now sum of sides = 20 + 13 + 11 = 44. ∴ $s = 22$.

$$\therefore A = \sqrt{22 \times 9 \times 11 \times 2}.$$

$$= \sqrt{22 \times (3)^2 \times 22 \cdot}$$

$$= \sqrt{(22)^2 \times (3)^2 \cdot}$$

= 66 sq. chains.

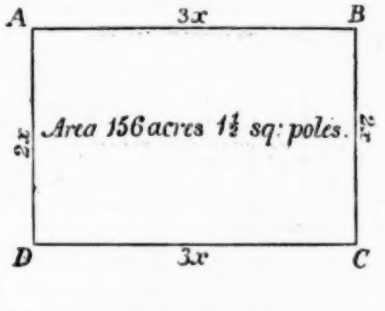
= 6·6 acres. Ans.

(*b*) Now Area = Perpendicular × by half of base.

∴ 66 sq. chains = P × 10 chains.

$$\therefore \frac{66 \text{ sq. chains}}{10 \text{ chains}} = P = 6{\cdot}6 \text{ chains.}$$ Ans.

2. The sides of a rectangular piece of ground are in the ratio of 2 to 3, and its area is 156 acres 1½ sq. poles. Find the side.



Let length = 3x; then breadth = 2x; Area = 6x^2.

∴ 6x^2 = 156 acres 1½ sq. poles = 24961½ sq. poles.

∴ x^2 = 4160·25 sq. poles.

∴ x = 64·5 poles = 1 furl. 24½ poles.

∴ AB = 3x = 4 furls. 33½ poles } Ans.

∴ BC = 2x = 3 " 9 " }

SPECIMEN NOTE, TIME, AND EAR TESTS FOR THE CODE EXAMINATION.

BY W. G. MCNAUGHT,
Associate of the Royal Academy of Music.

SCHOOL DIVISION IV.—STANDARD V. and upwards, and Pupil Teachers, Second Year.

TIME TEST.

CODE REQUIREMENTS.

Tonic Sol-fa.

To sing in one tone, one or more series of notes in two-pulse, three-pulse, or four-pulse measure, including pulse-and-a-half notes; also a simple phrase in six-pulse measure, beating twice to a measure.

The new points are (1) the introduction of pulse-and-a-half notes; and (2) six-pulse measure, beating twice to a measure, *i.e.*, once to each three-pulses or half-measure.

PRELIMINARY TESTS.

203. *Two-Pulse Measure.*

d :—	d :—	d :d.d	d :—
d :-.d	d :-.d	d :d	d :—
d :-.d	d :d	d :—	d :—
d :-.d	d :d	d :d	d :—

204. *Three-Pulse Measure.*

d :d :d	d :d.d:d	d :-.d:d	d :— :—
d :d.d:d	d :-.d:d	d :-.d:d	d :— :—

205. *Four-Pulse Measure.*

d :— |— :—	d :d.d | d :—	d :-.d | d :d
d :-.d | d :—	d :— | d :—	d :-.d | d :—
d :d.d | d :d	d :-.d | d :—	

206. *Six-Pulse Measure.*

Phrases to be patterned by the teacher and imitated by the pupils *before* the notation is shown.

Beat	1	2	1	2
(*a*)	d :— :—	d :— :—	d :d :d	d :— :—
(*b*)	d :d :d	d :d :d	d :d :d	d :— :—
(*c*)	d :d :d	d :— :—	d :d :d	d :— :—
(*d*)	d :— :d	d :— :—	d :— :d	d :— :—
(*e*)	d :— :d	d :— :d	d :— :d	d :— :—
(*f*)	d :— :—	d :— :—	d :— :d	d :— :—
(*g*)	d :— :d	d :— :d	d :d :d	d :— :—

After this process of introduction to the rhythmic effect the above exercise should be written on the board and again patterned and imitated, the teacher, meanwhile, pointing on the board, taking care in doing so to move the pointer twice in a measure. When this is accomplished the class will be fit to hear explanations.

STANDARD TESTS.

207. *Two-Pulse Measure.*

d :—	d :	d :-.d	d :—
d :d.d	d :-.d	d.d :d.d	d :—
d :-.d	d.d :d	d :d	d :
d :-.d	d.d :d	d :-.d	d :—

208.

d :—	d :—	d.d :d.d	d :—
d :-.d	d :—	d.d :d.d	d.d :d
d :-.d	d :—	:d	d :—
:d	d.d :d	d :-.d	d :—

209. *Three-Pulse Measure.*

d :— :—	d :-.d:d	d :d.d:d	d :-.d:d
d :-.d:d	d.d:d.d:d	d :-.d:d	d :— :

210.

d : :d	d : :d	d :-.d:d	d :d.d:d
d :-.d:d	d :-.d:d.d	d :— :—	d :— :—

211.

d :d :	d :d.d:d	d : :	d :— :—
d :-.d:d	d :d.d:d	d :-.d:d.d	d :— :—

212. *Four-Pulse Measure.*

d :— |— :d	d :-.d | :d	d :d.d | d :—
d :-.d | d.d:d	d :d.d | d.d:d	d :d | :-.d
d.d :d.d | d :-.d	d.d:d | d :—	

213.

d :-.d | d :	d :d | d.d:d	d :-.d | d.d:d
d :— |— :—	d :d.d | d :-.d	d : | d :
d : | d :-.d	d :— | :	

214.

d :d | d.d:d	d :-.d | d.d:d	d :— |— :—
d :d.d | d :—	d :— |— :—	d :d | d.d:d
d :-.d | d :d	d :d.d | d :—	

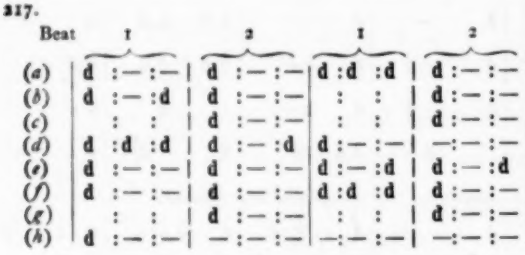
215. *Six-Pulse Measure.*

Beat	1	2	1	2
(*a*)	d :— :—	d :— :—	d :d :d	d :— :—
(*b*)	d :— :d	d :— :d	d :d :d	d :— :—
(*c*)	: :	d :— :—	: :	d :— :—
(*d*)	d :— :—	—:— :—	—:— :—	—:— :—
(*e*)	d :— :d	d :— :d	d :— :d	d :— :—
(*f*)	: :	d :d :d	d :— :d	d :— :—
(*g*)	d :— :d	d :d :d	d :d :d	d :— :—
(*h*)	d :— :—	d :— :—	d :— :—	—:— :—

216.

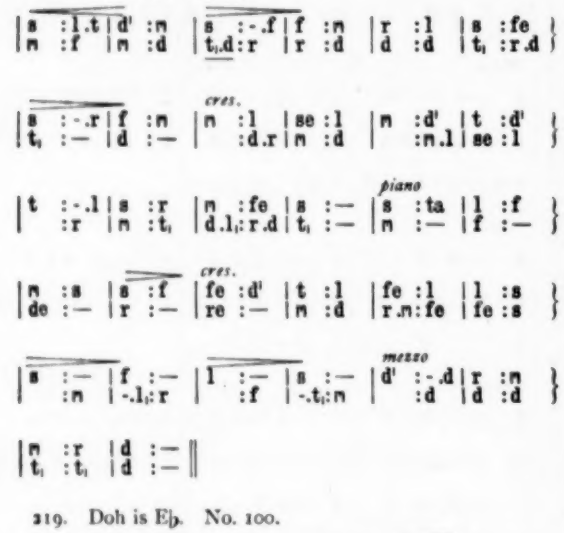
Beat	1	2	1	2
(*a*)	d :d :d	d :— :—	d :d :d	d :— :—
(*b*)	d :— :d	d :— :d	d :— :—	—:— :—
(*c*)	d :— :—	: :	d :— :—	: :
(*d*)	d :— :d	d :d :d	d :d :d	d :— :—
(*e*)	d :— :—	d :d :d	d :— :d	d :— :d
(*f*)	d :— :d	d :— :d	d :d :d	d :— :—
(*g*)	d :— :d	d :d :d	d :— :d	d :d :d
(*h*)	: :	d :— :—	d :— :—	—:— :—

217.

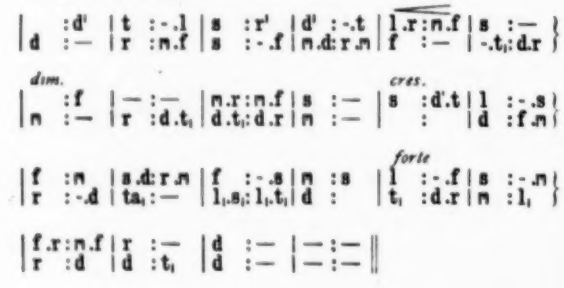


Beyond the Code.

The following two-part tests combine the time of this Division with simple tune. They are suitable practice for Upper Standards and furnish useful preliminary studies for Pupil Teachers preparing for the Third Year Examination, the practical requirements for which include tests combining *all* the time and tune (including transition) work of Division IV. (Schools.)

218. Doh is D. M. 80.

s :l.t | d' :m | s :-.f | f :m | r :l | s :fe
m :f | m :d | t, d :r | r :d | d :d | t, :r.d
cres.
s :-.r | f :m | m :l | se :l | m :d' | t :d'
t, :— | d :— | :d.r | m :d | :m.l | se :l
piano
t :-.l | s :r | m :fe | s :— | s :ta | l :f
:r | m :t, | d.l, :r.d | t, :— | m :— | f :—
cres.
m :s | s :f | fe :d' | t :l | fe :l | l :s
de :— | r :— | re :— | m :d | r.m :fe | fe :s
mezzo
s :— | f :— | l :— | s :— | d' :-.d | r :m
:m | -.l, :r | :f | -.t, :m | :d | d :d
m :r | d :— ‖
t, :t, | d :— ‖

219. Doh is E♭. No. 100.


:d' | t :-.l | s :r' | d' :-.t | l.r :m.f | s :—
d :— | r :m.f | s :-.f | m.d :r.m | f :— | -.t, :d.r
dim.
:f | — :— | m.r :m.f | s :— | cres. s :d'.t | l :-.s
m :— | r :d.t, | d.t, :d.r | m :— | : | d :f.m
forte
f :m | s.d :r.m | f :-.s | m :s | l :-.f | s :-.m
r :-.d | ta, :— | l, s, :l, t, | d : | t, :d.r | m :l,
f.r :m.f | r :— | d :— | — :— ‖
r :d | d :t, | d :— | — :— ‖

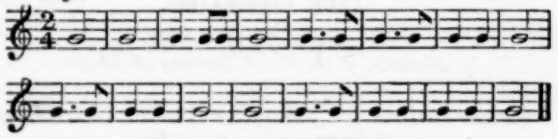
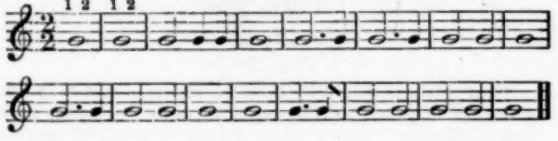
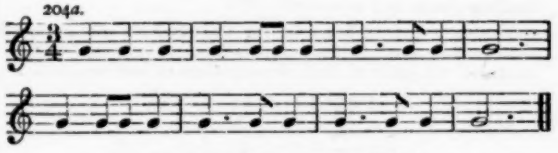
Code Requirement.

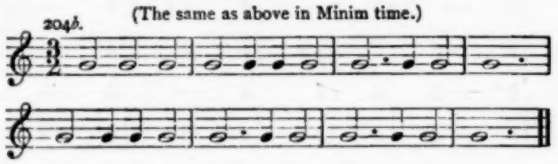
Staff Notation.

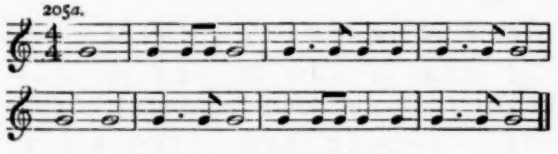
To sing on one sound, one or more series of notes and rests in $\frac{2}{2}$, $\frac{4}{4}$, $\frac{3}{4}$ and $\frac{3}{2}$ times which may include dotted minims and (in crotchet time) dotted crotchets; also a simple phrase in $\frac{6}{8}$ time, counting two beats in a bar.

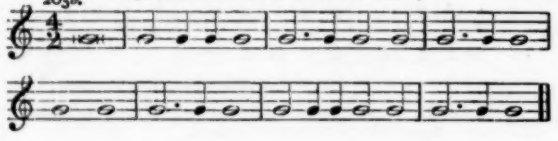
The new points are (1) the use of 'minim' time, *i.e.*, the use of the minim as a beat or pulse; (2) the use of dotted crotchets with the crotchet as a pulse; and (3) the use of $\frac{6}{8}$ or six quaver time.

Preliminary Tests.

203*a*.

203*b*. (The same as above in Minim time.)

204*a*.

204*b*. (The same as above in Minim time.)



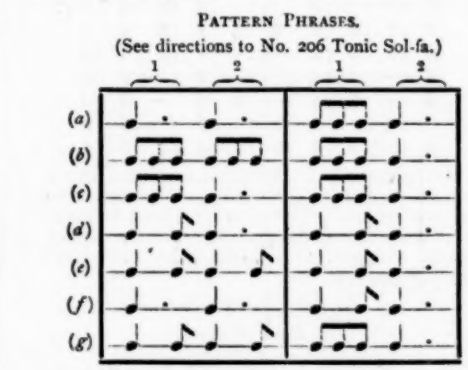
205*a*.

205*b*. (The same as above in Minim time.)



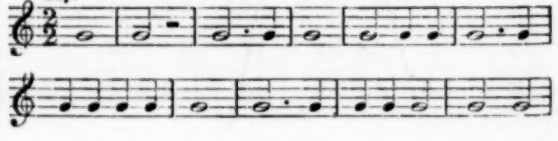
206. $\frac{6}{8}$—Six Quaver or Two Dotted-crotchet time.

Pattern Phrases.

(See directions to No. 206 Tonic Sol-fa.)



Standard Tests.

207.

208.

209.

210.

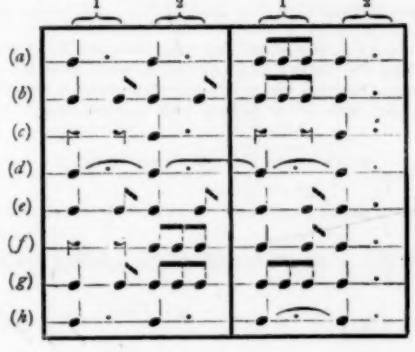
211.

212.

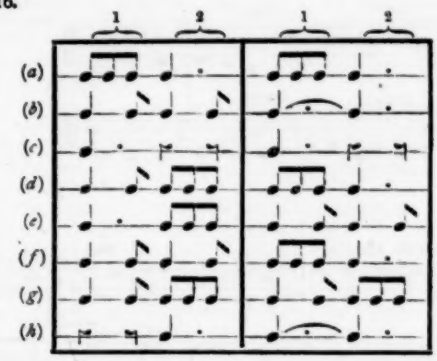
213.

214.

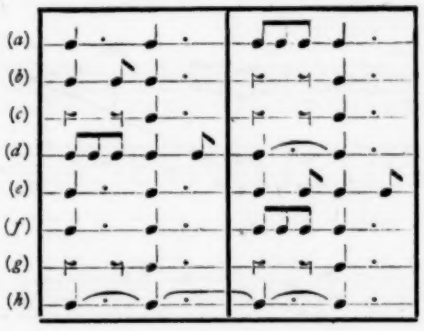
215. $\frac{6}{8}$—Six Quaver or Two Dotted-crotchet time.



216.

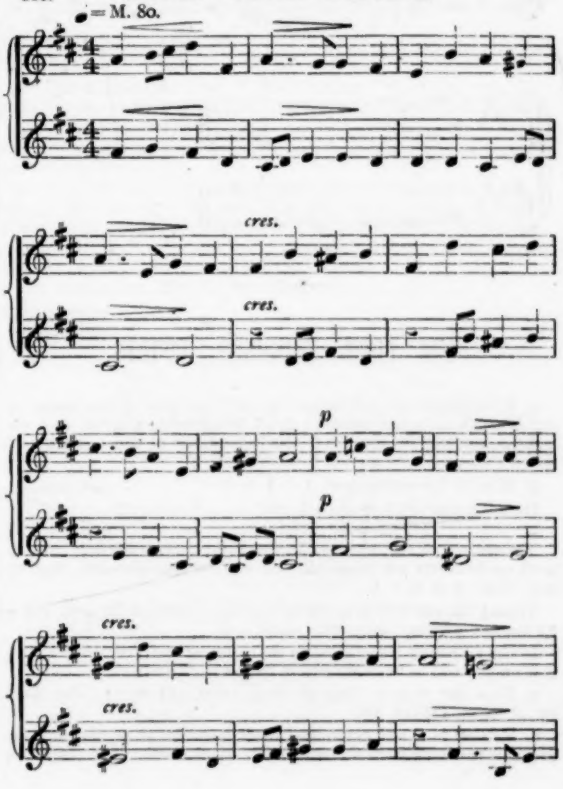
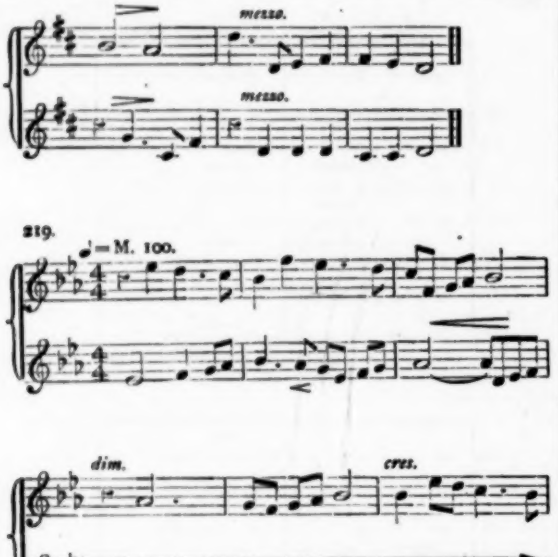


217.



COMBINED TIME AND TUNE.

(See Note over No. 218 Tonic Sol-fa.)

218. ♩ = M. 80.

OUR PUPIL TEACHERS' COURSE.

α. This month we shall devote the principal part of the space at our disposal to a few remarks upon Arithmetic, and for this we make no apology on account of the importance of the subject, and the weakness evinced therein by many P.T.'s.

β. What is the meaning of $\frac{1}{2} \div \frac{1}{2} \div \frac{1}{2}$?

Does it equal (*a*) $\frac{1}{2} \div (\frac{1}{2} \div \frac{1}{2})$, or
(*b*) $(\frac{1}{2} \div \frac{1}{2}) \div \frac{1}{2}$?

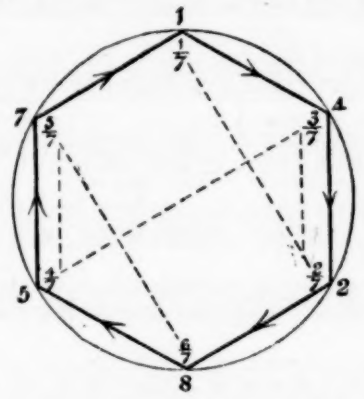
The second of the two (*b*) is the right interpretation; but in truth no brackets are required; but merely simplification step by step, thus—$\frac{1}{2} \times \frac{2}{1} \times \frac{1}{2}$.

Taking the expression in the wrong way [method (*a*)], we get *1* for answer, whereas the correct result is $\frac{1}{2}$.

In the following remarks when we speak of the V.F. = to a dec. it is understood to be expressed in its lowest terms.

γ. Note that $\dot{9} = 1$; that $\cdot4\dot{9} = \cdot5$; that $\cdot32\dot{9} = \cdot33$; that $\cdot4285\dot{7} = \cdot428574 = 428574\dot{2}$, etc.

δ. Related to $\dot{9}$ and exhibiting most beautiful properties are the decimals resulting from the conversion of *sevenths*. (See diagram.)



It is only necessary to know by heart the decimal ($\cdot\dot{1}42857\dot{1}$) for $\frac{1}{7}$, and we then have the decimal for all the remaining *sevenths*, viz., $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, $\frac{5}{7}$, $\frac{6}{7}$.

Observe that the figures 142857 are placed in order round the hexagon.

Then $\cdot4285\dot{7}\dot{1} = \frac{3}{7}$; $\cdot\dot{2}85714\dot{2} = \frac{4}{7}$, etc.

Note that the fractions at the ends of a diameter together make unity, and then by expressing *1* as $\cdot\dot{9}$ we easily obtain from $\frac{1}{7}$ the value of $\frac{6}{7}$, *e.g.*—

$$1 = \frac{1}{7} + \frac{6}{7}$$
$$\cdot\dot{9} = \cdot\dot{1}42857\dot{1} + \frac{6}{7}.$$
$$(\cdot999999\ldots) - (\cdot142857\ldots) = \frac{6}{7}$$
$$\cdot857142\dot{8} \qquad\qquad = \frac{6}{7} \text{ Ans.}$$

The same result would, of course, follow from multiplication.

$$\frac{6}{7} = \frac{1}{7} \times 6 = \cdot\dot{1}42857\dot{1} \times 6 = \cdot\dot{8}57142\dot{8} \text{ Ans.}$$

ε. In any repeating decimal the number of places cannot exceed (but may be less than) one less than the number denoted by the denominator of the corresponding Vulgar Fraction. Thus the decimal representing any number of *sevenths* cannot contain more than 6 places.

This is easily demonstrated. For when we divide by 7, there can only be six different remainders (*0* being excluded, or otherwise the decimal would be finite), and when the same remainder recurs, the same dividend and quotient recur.

ζ. Every fraction whose denominator will break up into ultimate factors of fives and twos is finite or terminating, *e.g.*, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{7}{10}$, $\frac{3}{80}$, etc.

η. In any terminating decimal the number of decimal places depends upon the number of times the factors *2* or *5* enter into the composition of its denominator. Thus, $\frac{1}{5}$, $\frac{1}{2}$ and $\frac{7}{10}$ will have one decimal place; $\frac{3}{80}$, $\frac{3}{8}$, $\frac{3}{100}$ will have two decimal places $\frac{9}{125}\left(=\frac{9}{5\times5\times5}\right)$, $\frac{3}{8}\left(=\frac{3}{2\times2\times2}\right)$ and $\frac{9}{1000} = \left(\frac{9}{5\times5\times5\times2\times2\times2}\right)$ will have three decimal places.

Algebraically, $\frac{x}{5^m}$, $\frac{x}{2^m}$ and $\frac{x}{5^m \times 2^m}$ will have m places; and when m is greater than n $\frac{x}{5^m \times 2^n}$ and $\frac{x}{5^n \times 2^m}$ will have m places.

θ. Any Vulgar Fraction whose denominator contains any other factor but *2* or *5* will convert into a non-terminating decimal.

ι. Any Vulgar Fraction whose denominator contains the factors *2* or *5* together with other factors with convert into a *mixed repeater*.

$\frac{1}{6} = \frac{1}{2\times3} = \cdot1\dot{6}$ having one non-repeating figure.

$\frac{1}{15} = \frac{1}{5\times3} = \cdot0\dot{6}$ " " " "

$\frac{1}{12} = \frac{1}{2\times2\times3} = \cdot08\dot{3}$ having two non-repeating figures.

$\frac{1}{75} = \frac{1}{5\times5\times3} = \cdot01\dot{3}$ " " " " etc.

κ. If a Vulgar Fraction be $\frac{x}{5^m \times 2^m \times y}$ the equivalent decimal will not contain more than $m + y - 1$ places.

See (ε) and (η).

λ. When the first half of the figures of a pure repeater with the maximum number of places is known, the second half may be obtained by subtraction from 9999 . . . ., *e.g.*—

Half of the decimal places in $\frac{1}{7} = \cdot142$, then the remaining half will $= 999 - 142 = 857$, making the whole decimal $\cdot142857\dot{}$.

Again, half of the decimal places of $\frac{1}{17} = \cdot05882352$, ∴ the remaining half will $= 99999999 - \cdot05882352 = 94117647$, making the total decimal $= \cdot0588235294117647\dot{}$.

So that in a pure repeater whose corresponding V.F. has denominator $2x + 1$, the number of places cannot exceed $2x$, and of these only x need be obtained by division.

μ From (ι) it follows that every pure repeater has an odd number for the denominator of its V.F.

ν When any pure repeater has more digits than there are in the denominator of its V.F. it will be divisible by nine.

ξ In converting a V.F. to a pure repeater the decimal will begin to recur the next figure after the sum of the remainders is divisible by the denominator.

Examples—

$\frac{1}{7} = \cdot142857\dot{}$

(*a*)

7	1·000000
	·142857 . . . .

1,3,2,6,4,5 . . . . Remainders.

Note that the first and fourth, second and fifth, third and sixth remainders total 7.

(*b*) $\frac{1}{17} = \cdot0588235294117647\dot{}$

17	1·0 0 0 0000 0 0000 0 0000
	·0 5 8 8 2 3 5 2 9 4 1 1 7 6 4 7 . . .

1,10,15,14,4,6,9,5,16,7,2,3,13,11,8,12 . . . . Remainders.

Note that the sum of the first and ninth, second and tenth, third and eleventh remainders, etc., = 17.

ο When in converting (dividing by denominator m), we get a first remainder n, the second half of the decimal digits will begin when the remainder $= m - n$.

See examples (*a*) and (*b*) supra, also (*c*) infra.

(*c*) $\frac{1}{13} = \cdot076923\dot{}$

13	1·0 0 0 0 0 0
	·0 7 6 9 2 3 . . .

1,10,9,12,3,4 . . . . Remainders.

In example (*c*), when we get remainder 12, we know we have half of the required places, and we can obtain the other half (by Article λ) without division. Where the number of places is odd (say $2x + 1$), then $x + 1$ places must be obtained.

π Article (*e*) shows that number of decimal places in a pure repeater cannot be more than $m - 1$ when denominator of V.F. $= m$.

When the number of decimal places is less, it is always a factor of $m - 1$.

See example (*c*) supra, where $m = 13$; $m - 1 = 12$; and number of places $= 6$ a factor of 12.

Example (*d*) $\frac{1}{41} = \cdot02439\dot{}$.

41	1·0 0 0 0 0
	·0 2 4 3 9 . . .

1,10,18,16,37 . . . Remainders.

Here $m = 41$; $m - 1 = 40$; number of places $= 5$ a factor of 40.

ρ The following proof of the conversion of a mixed repeater is found in most Arithmetics, but is too often overlooked by the Pupil Teacher to be here omitted.

To prove that $\cdot42\dot{3}\dot{6} = \frac{4194}{9900}$

10000 times $\cdot42\dot{3}\dot{6} = 4236\cdot3636 \ldots$

100 " " $= 42\cdot3636 \ldots$

∴ 9900 " " $= 4194$

∴ $\cdot42\dot{3}\dot{6} = \frac{4194}{9900} = \frac{233}{550}$ Q.E.D.

σ Sometimes it is possible to cancel by repeaters, *e.g.*—

Example (*e*)

$$\frac{1\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{2}} \times \frac{2\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{3}} = \frac{1\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{3}} \times \frac{2\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{2}} = \frac{1\cdot\dot{3}\dot{6} \div \cdot\dot{4}\dot{1}}{1\cdot\dot{7}\dot{3} \div \cdot\dot{4}\dot{1}} \times \frac{2\cdot\dot{3}\dot{6} \div \cdot\dot{3}\dot{7}}{1\cdot\dot{7}\dot{2} \div \cdot\dot{3}\dot{7}} =$$

$$\frac{3}{4} \times \frac{4}{3} = \frac{1}{1} \text{ Ans.}$$

τ Example (*e*) illustrates one notable difference between repeaters and ordinary decimals. A nought at the right-hand end of the latter does not alter the value, but a nought at end of repeater materially diminishes the value.

$\cdot\dot{3}\dot{0} = \cdot303030 \ldots$. not $\cdot33333 \ldots$

υ With respect to addition and subtraction of repeaters (whether performed through the medium of conversion to V.F. or otherwise) two points should be remembered.

(*a*) The sum of any number of repeating decimals is itself a repeating decimal.

(*b*) The number of digits in its period is generally the L.C.M. of the number of digits in the given periods.

φ. Repeating, Circulating, Recurring Periodic, Infinite Decimals are merely five different names for denoting the same kind of decimals.

χ. A Repeater is a Geometrical Progression. Thus—

$$\cdot\dot{3}\dot{6} = \tfrac{36}{100} + \tfrac{36}{10000} + \tfrac{36}{1000000} \ldots$$

Here each term is derived from the preceding by multiplying it by $\frac{1}{100}$. The proof is exactly the same as in Article ρ.

100 times :—

$\frac{36}{100} + \frac{36}{10000} + \frac{36}{1000000}$, etc., $= 36 + \frac{36}{100} + \frac{36}{10000} + \frac{36}{1000000} \ldots$

Once " " " $= \frac{36}{100} + \frac{36}{10000} + \frac{36}{1000000}$

etc.

ψ. Questions are now sometimes set involving *minus or negative quantities* for answers. Even where this is not the case, it frequently happens that at some intermediate step in the solution the quantity is minus.

A very easy example occurs in Question 3 of First Year, Girls' Arithmetic: $\frac{1}{10} - \frac{1}{4} + \frac{3}{5} - \frac{1}{15}$.

Here $\frac{1}{4}$ is greater than $+ \frac{1}{10}$. (See Model Answers.)

ω. We hope in another Article to deal with 'Problems of Motion,' Mixtures, Problems of Mixed Agents, etc.

(*a*) The mode of examining Scholarship Candidates in Reading, Recitation, and Teaching has been so universally condemned by H.M. Inspectors and teachers that it will be considerably altered in the next issue of the Code.

(*b*) Further particulars with respect to the testing of Pupil Teachers in Practical Music are to hand. Five songs must be presented, which should not be the same as those learnt by the scholars. One of these will be selected by and performed before H.M. Inspector.

The song must be easy and not of necessity requiring an accompaniment.

(*c*) One noteworthy effect of the McKinley tariff has been the great impetus thereby given to Canadian trade with Great Britain.

The extent and variety of Canadian productions is well exemplified by the cargo of the *Mongolian*, which discharged at Liverpool last month.

It comprised 481 cows, 2 horses, 371 boxes of hams, 86 cases of bacon, 1,000,000 eggs, 10 cases of honey, 1,258 packages of butter, 14,636 boxes of cheese, 26,000 bhls. of maize, 620 sacks of oatmeal, 18,200 bhls. of wheat, 2,200 sacks of flour, 7,900 barrels of apples, 95 bales of hops, and 107 cases of rye whisky.

(*d*) Analyse the following and parse the italicised words :—

First Monday.

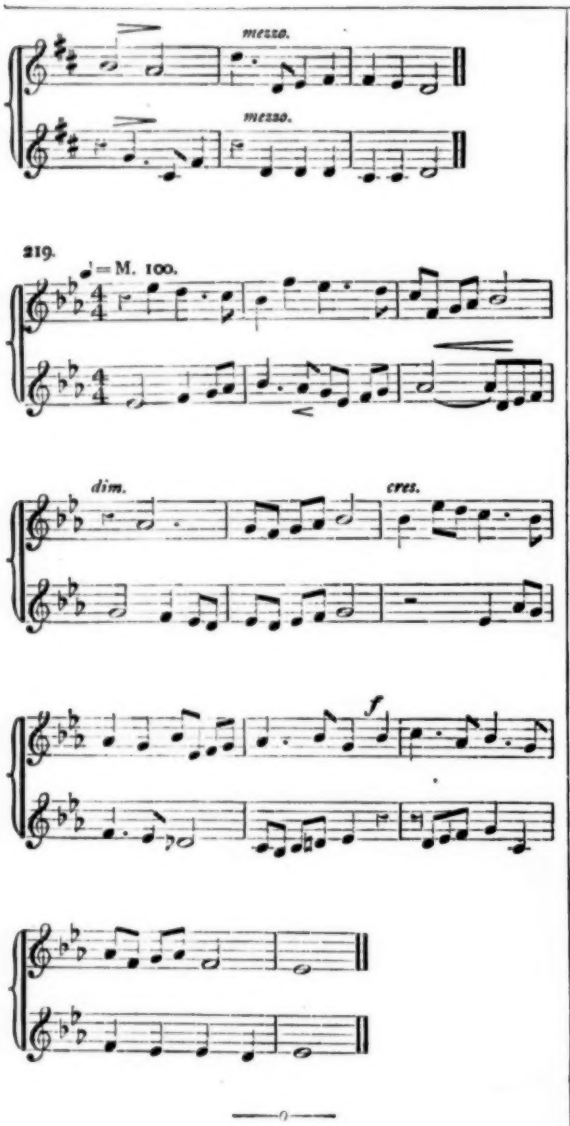
First Year—

There is a glorious *City* in the Sea,
The sea *is* in the broad, the narrow *streets*,
Ebbing and *flowing*, and the salt sea-weed
Clings to the marble *of her* palaces.
No track of men, no *footsteps* to and *fro*
Lead to her *gates*.—*Rogers.*

Second Year—

What time the *daisy* decks the green
Thy *certain voice* we hear.
Hast thou a star *to guide thy* path
Or mark the rolling *year*?
Delightful *visitant*, with thee
I hail the *time* of flowers.—*Logan.*

Third Year—

She is not *fair* to outward view,
As many *maidens be*;
Her *loveliness* I never knew
Until she *smiled* on me;
Oh, then I *saw her* eye was bright,
A well of love, a *spring* of light.—*Hartley Coleridge.*

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Does it equal (*a*) $\frac{3}{4} \div (\frac{2}{5} \div \frac{1}{2})$, or

(*b*) $(\frac{3}{4} \div \frac{2}{5}) \div \frac{1}{2}$?

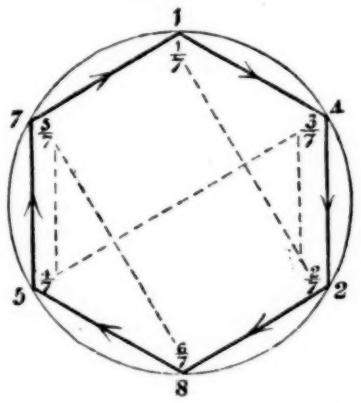
The second of the two (*b*) is the right interpretation; but in truth no brackets are required; but merely simplification step by step, thus—$\frac{3}{4} \times \frac{5}{2} \times \frac{1}{2}$.

Taking the expression in the wrong way [method (*a*)], we get 1 for answer, whereas the correct result is $\frac{3}{8}$.

In the following remarks when we speak of the V.F. = to a dec. it is understood to be expressed in its lowest terms.

γ. Note that $\cdot\dot{9} = 1$; that $\cdot 4\dot{9} = \cdot 5$; that $\cdot 32\dot{9} = \cdot 33$; that $\cdot 42\dot{8}\dot{5} = \cdot 42854 = 42854\frac{2}{7}$, etc.

δ. Related to $\cdot\dot{9}$ and exhibiting most beautiful properties are the decimals resulting from the conversion of *sevenths*. (See diagram.)



It is only necessary to know by heart the decimal ($\cdot\dot{1}42857\dot{1}$) for $\frac{1}{7}$, and we then have the decimal for all the remaining *sevenths*, viz., $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, $\frac{5}{7}$, $\frac{6}{7}$.

Observe that the figures 142857 are placed in order round the hexagon.

Then $\cdot\dot{4}2857\dot{1} = \frac{3}{7}$; $\cdot 2857\dot{1}\dot{4} = \frac{2}{7}$, etc.

Note that the fractions at the ends of a diameter together make unity, and then by expressing 1 as $\cdot\dot{9}$ we easily obtain from $\frac{1}{7}$ the value of $\frac{6}{7}$, *e.g.*—

$$1 = \tfrac{1}{7} + \tfrac{6}{7}$$
$$\cdot\dot{9} = \cdot\dot{1}42857\dot{1} + \tfrac{6}{7}.$$
$$(\cdot 999999\ldots) - (\cdot 142857\ldots) = \tfrac{6}{7}$$
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The same result would, of course, follow from multiplication.

$$\tfrac{6}{7} = \tfrac{1}{7} \times 6 = \cdot\dot{1}42857\dot{1} \times 6 = \cdot\dot{8}57142\dot{8} \text{ Ans.}$$

ε. In any repeating decimal the number of places cannot exceed (but may be less than) one less than the number denoted by the denominator of the corresponding Vulgar Fraction. Thus the decimal representing any number of *sevenths* cannot contain more than 6 places.

This is easily demonstrated. For when we divide by 7, there can only be six different remainders (0 being excluded, or otherwise the decimal would be finite), and when the same remainder recurs, the same dividend and quotient recur.

ζ. Every fraction whose denominator will break up into ultimate factors of fives and twos is finite or terminating, *e.g.*, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{8}$, $\frac{7}{10}$, $\frac{3}{100}$, etc.

η. In any terminating decimal the number of decimal places depends upon the number of times the factors 2 or 5 enter into the composition of its denominator. Thus, $\frac{1}{5}$, $\frac{1}{2}$ and $\frac{1}{10}$ will have one decimal place; $\frac{3}{25}$, $\frac{3}{8}$, $\frac{1}{100}$ will have two decimal places $\frac{9}{125}\left(=\frac{9}{5\times5\times5}\right)$, $\frac{3}{8}\left(=\frac{3}{2\times2\times2}\right)$ and $\frac{9}{1000} = \left(\frac{9}{5\times5\times5\times2\times2\times2}\right)$ will have three decimal places.

Algebraically, $\frac{x}{5^m}$, $\frac{x}{2^m}$ and $\frac{x}{5^m \times 2^m}$ will have m places; and when m is greater than n $\frac{x}{5^m \times 2^n}$ and $\frac{x}{5^n \times 2^m}$ will have m places.

θ. Any Vulgar Fraction whose denominator contains any other factor but 2 or 5 will convert into a non-terminating decimal.

ι. Any Vulgar Fraction whose denominator contains the factors 2 or 5 together with other factors with convert into a *mixed repealer*.

$\frac{1}{6} = \frac{1}{2\times3} = \cdot 1\dot{6}$ having one non-repeating figure.

$\frac{1}{15} = \frac{1}{5\times3} = \cdot 0\dot{6}$ " " " "

$\frac{1}{12} = \frac{1}{2\times2\times3} = \cdot 08\dot{3}$ having two non-repeating figures.

$\frac{1}{75} = \frac{1}{5\times5\times3} = 01\dot{3}$ " " " " etc.

κ. If a Vulgar Fraction be $\frac{x}{5^m \times 2^m \times y}$ the equivalent decimal will not contain more than $m + y - 1$ places.

See (ε) and (η).

λ. When the first half of the figures of a pure repeater with the maximum number of places is known, the second half may be obtained by subtraction from 9999 . . . ., *e.g.*—

Half of the decimal places in $\frac{1}{7} = \cdot142$, then the remaining half will $= 999 - 142 = 857$, making the whole decimal $\cdot142857\dot{}$.

Again, half of the decimal places of $\frac{1}{17} = \cdot05882352$, $\therefore$ the remaining half will $= 99999999 - \cdot05882352 = 94117647$, making the total decimal $= \cdot0588235294117647\dot{}$.

So that in a pure repeater whose corresponding V.F. has denominator $2x + 1$, the number of places cannot exceed $2x$, and of these only x need be obtained by division.

μ From (ι) it follows that every pure repeater has an odd number for the denominator of its V.F.

ν When any pure repeater has more digits than there are in the denominator of its V.F. it will be divisible by nine.

ξ In converting a V.F. to a pure repeater the decimal will begin to recur the next figure after the sum of the remainders is divisible by the denominator.

Examples—

$\frac{1}{7} = \cdot142857\dot{}$

(*a*)

7	1·000000
	·142857 . . . .

1,3,2,6,4,5 . . . . Remainders.

Note that the first and fourth, second and fifth, third and sixth remainders total 7.

(*b*) $\frac{1}{17} = \cdot0588235294117647\dot{}$

17	1·0 0 0 00000 0 0000 0 0000 0
	·0 5 8 8 2 3 5 2 9 4 1 1 7 6 4 7 . . .

1,10,15,14,4,6,9,5,16,7,2,3,13,11,8,12 . . . . Remainders.

Note that the sum of the first and ninth, second and tenth, third and eleventh remainders, etc., $= 17$.

ο When in converting (dividing by denominator m), we get a first remainder n, the second half of the decimal digits will begin when the remainder $= m - n$.

See examples (*a*) and (*b*) supra, also (*c*) infra.

(*c*) $\frac{1}{13} = \cdot076923\dot{}$

13	1·0 0 0 000
	·0 7 6 9 2 3 . . .

1,10,9,12,3,4 . . . . Remainders.

In example (*c*), when we get remainder 12, we know we have half of the required places, and we can obtain the other half (by Article λ) without division. Where the number of places is odd (say $2x + 1$), then $x + 1$ places must be obtained.

π Article (ε) shows that number of decimal places in a pure repeater cannot be more than $m - 1$ when denominator of V.F. $= m$.

When the number of decimal places is less, it is always a factor of $m - 1$.

See example (*c*) supra, where $m = 13$; $m - 1 = 12$; and number of places $= 6$ a factor of 12.

Example (*d*) $\frac{1}{41} = \cdot02439\dot{}$.

41	1·0 0 0 0 0
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Here $m = 41$; $m - 1 = 40$; number of places $= 5$ a factor of 40.

ρ The following proof of the conversion of a mixed repeater is found in most Arithmetics, but is too often overlooked by the Pupil Teacher to be here omitted.

To prove that $\cdot42\dot{3}\dot{6} = \frac{233}{550}$

10000 times $\cdot42\dot{3}\dot{6} = 4236{\cdot}3636 \ldots$

100 " " $= 42{\cdot}3636 \ldots$

$\therefore$ 9900 " " $= 4194$

$\therefore$ $\cdot42\dot{3}\dot{6} = \frac{4194}{9900} = \frac{233}{550}$ Q.E.D.

ς Sometimes it is possible to cancel by repeaters, *e.g.*—

Example (*e*)

$$\frac{1\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{2}} \times \frac{2\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{3}} = \frac{1\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{3}} \times \frac{2\cdot\dot{3}\dot{6}}{1\cdot\dot{7}\dot{2}} = \frac{1\cdot\dot{3}\dot{6} \div \cdot\dot{4}\dot{3}}{1\cdot\dot{7}\dot{3} \div \cdot\dot{4}\dot{3}} \times \frac{2\cdot\dot{3}\dot{6} \div \cdot\dot{5}\dot{7}}{1\cdot\dot{7}\dot{2} \div \cdot\dot{5}\dot{7}} =$$

$$\frac{3}{4} \times \frac{4}{3} = \frac{1}{\ }$$ Ans.

τ Example (*e*) illustrates one notable difference between repeaters and ordinary decimals. A nought at the right-hand end of the latter does not alter the value, but a nought at end of repeater materially diminishes the value.

$\cdot\dot{3}\dot{6} = \cdot303030 \ldots$. not $\cdot33333 \ldots$

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(*b*) The number of digits in its period is generally the L.C.M. of the number of digits in the given periods.

φ. Repeating, Circulating, Recurring Periodic, Infinite Decimals are merely five different names for denoting the same kind of decimals.

χ. A Repeater is a Geometrical Progression. Thus—

$$\cdot\dot{3}\dot{6} = \tfrac{36}{100} + \tfrac{36}{10000} + \tfrac{36}{1000000} \ldots$$

Here each term is derived from the preceding by multiplying it by $\frac{1}{100}$. The proof is exactly the same as in Article ρ.

100 times :—

$\frac{36}{100} + \frac{36}{10000} + \frac{36}{1000000}$, etc., $= 36 + \frac{36}{100} + \frac{36}{10000} + \frac{36}{1000000} \cdots$

Once " " " $= \frac{36}{100} + \frac{36}{10000} + \frac{36}{1000000}$

etc.

ψ. Questions are now sometimes set involving *minus or negative quantities* for answers. Even where this is not the case, it frequently happens that at some intermediate step in the solution the quantity is minus.

A very easy example occurs in Question 3 of First Year, Girls' Arithmetic: $\frac{1}{10} - \frac{1}{4} + \frac{3}{5} - \frac{1}{15}$.

Here $\frac{1}{4}$ is greater than $+ \frac{1}{10}$. (See Model Answers.)

ω. We hope in another Article to deal with 'Problems of Motion,' Mixtures, Problems of Mixed Agents, etc.

(*a*) The mode of examining Scholarship Candidates in Reading, Recitation, and Teaching has been so universally condemned by H.M. Inspectors and teachers that it will be considerably altered in the next issue of the Code.

(*b*) Further particulars with respect to the testing of Pupil Teachers in Practical Music are to hand. Five songs must be presented, which should not be the same as those learnt by the scholars. One of these will be selected by and performed before H.M. Inspector.

The song must be easy and not of necessity requiring an accompaniment.

(*c*) One noteworthy effect of the McKinley tariff has been the great impetus thereby given to Canadian trade with Great Britain.

The extent and variety of Canadian productions is well exemplified by the cargo of the *Mongolian*, which discharged at Liverpool last month.

It comprised 481 cows, 2 horses, 371 boxes of hams, 86 cases of bacon, 1,000,000 eggs, 10 cases of honey, 1,258 packages of butter, 14,636 boxes of cheese, 26,000 bhls. of maize, 620 sacks of oatmeal, 18,200 bhls. of wheat, 2,200 sacks of flour, 7,900 barrels of apples, 95 bales of hops, and 107 cases of rye whisky.

(*d*) Analyse the following and parse the italicised words :—

First Monday.

First Year—

There is a glorious *City* in the Sea,
The sea *is* in the broad, the narrow *streets*,
Ebbing and *flowing*, and the salt sea-weed
Clings to the marble *of her* palaces.
No track of men, no *footsteps* to and *fro*
Lead to her *gates*.—*Rogers.*

Second Year—

What time the *daisy* decks the green
Thy *certain voice* we hear.
Hast thou a star *to guide thy* path
Or mark the rolling *year?*
Delightful *visitant*, with thee
I hail the *time* of flowers.—*Logan.*

Third Year—

She is not *fair* to outward view,
As many *maidens be ;*
Her *loveliness* I never knew
Until she *smiled* on me ;
Oh, then I *saw her* eye *was* bright,
A well of love, a *spring* of light.—*Hartley Coleridge.*

PUPIL TEACHERS' ROUTINE FOR DECEMBER, 1892.

DAYS	YEAR	FIRST WEEK. 1st Lesson	FIRST WEEK. 2nd Lesson	FIRST WEEK. 3rd Lesson	SECOND WEEK. 1st Lesson	SECOND WEEK. 2nd Lesson	SECOND WEEK. 3rd Lesson	THIRD WEEK. 1st Lesson	THIRD WEEK. 2nd Lesson	THIRD WEEK. 3rd Lesson	FOURTH WEEK. 1st Lesson	FOURTH WEEK. 2nd Lesson	FOURTH WEEK. 3rd Lesson
MONDAY	1	Analysis and Parsing (See Remarks)	How to teach Spelling	Revision of Vulgar Fractions	Analysis and Parsing (See Remarks)	How to teach Reading	Any Revision	Composition or Paraphrasing	Subtraction of Algebra. Knitting Socks	Map of Scotland	Analysis and Parsing (See Remarks)	Revise Algebra. Stocking-hole mending	Geography of Australia
	2			Method of Unity Vulgar Fractions of Money					Multiplication of Algebra. Knitting Stocking	Map of Italy		Revise Algebra. Flannel Patch	Geography of India
	3		How to teach History	Stocks—Short methods with Repeaters		How to teach Arithmetic			Division of Algebra. Cross Cut Darn	Map of South Africa		G.C.M. of Algebra Hedge-tear Darn	Geography of Asia
TUESDAY	1	Revise any Euclid or Needle-work	Any Geography	Scripture or Revision	Revise any Euclid or Needle-work	Multip. of Vulgar Fracts. of Weights and Measures	Scripture or Revision	Euc., Bk. I. Prop. 3 Paper Patterns of Garments	Divis. of Vulg. Fract. Add. and Subt. of Vulg. Fct.	Scripture or Revision	Euc., Bk. I., Prop. 4 Paper Patterns of Garments	English from Text Book	Scripture or Revision
	2		Longitude			Method of Unity. Abstract Vulgar Fractions		Euc., Bk. I., Prop. 5 Paper Patterns of Garments	Theory of req. Rules		Euc., Bk. I., Props. 5 & 7. Paper Patterns of Garments		
	3		Winds			Square Root Simple Practice		Euc., Bk. I. Props. 33, 34. Paper Patterns of Garments	Mensuration of Triangles, Abstract Vulgar Fractions		Euc., Bk. I., 35, 36 Paper Patterns of Garments		
WEDNESDAY	1	History from 787 to 901 A.D.	English from Text Book	Any Advanced Work	Revise History	Prefixes, Roots or Affixes	Any Advanced Work	History from 901 to 1012 A.D.	Literature, Repetition, and Writing	Any Advanced Work	Dynastic Tables	Composition or Paraphrasing	Literature, Repetition, and Writing
	2	History from 1189 to 1216 A.D.			History from 1216 to 1270 A.D.			History from 1270 to 1307 A.D.			History from 1307 to 1327 A.D.		
	3	History from 1572 to 1602 A.D.			History from 1602 to 1624 A.D.			History from 1624 to 1637 A.D.			History from 1637 to 1649 A.D.		
THURSDAY	1	Geography of British North America	Compound Practice	Literature, Repetition, and Writing	Geography of British North America	Dates from 410 to 787 A.D.	Composition or Paraphrasing	Geography of Scotland	Any Revision	Lives of Historical Personages	Geography of Scotland	Multip. of Algebra Stocking-hole Mending	Dates from 787 to 901 A.D.
	2	Geography of India	Division into prop. parts. Proofs of Vulg. Fract. rules		Geography of Europe	Dates from 1189 to 1270 A.D.		Geography of Europe			Geography of Europe	Easy Algebraic Factors. Print Patch	Dates from 1270 to 1327 A.D.
	3	Geography of Africa	Stocks		Geography of Africa	Dates from 1572 to 1624 A.D.		Geography of Africa.			Geography of Africa	L.C.M. of Algebra Cross-cut Darn	Dates from 1624 to 1649 A.D.
FRIDAY	1	Problems in Addition and Subt. of Vulgar Fract.	Examination		Simple Practice	Examination		Add. and Subt. of Decimals. Household Accounts	Examination		Problems in Vulg. Fract. Diff. kinds of Fract.	Examination	
	2	Method of Unity Vulgar Fractions of Money			Theory of Propor. Any abstract Vulgar Fractions			Averages. Abstract Decimals			Averages. Abstract Repeaters		
	3	Discount. Theory of Repeating Decimals			Stocks. Money Decimals			Problems of Motion Compound Practice			Mensuration of Triangles. Abstract Decimals		
SATURDAY	1	French or Latin	Science	Freehand, Perspective, or Geometry / Music	French or Latin	Science	Freehand, Perspective, or Geometry / Music	French or Latin	Science	Freehand, Perspective, or Geometry / Music	French or Latin	Science	Freehand, Perspective, or Geometry / Music
	2												
	3												

Second Monday.

First Year—

What dreaming drone was ever *blest*
By *thinking* of the morrow?
To-day *be mine—I leave* the rest
To *all* the fools of sorrow.—*W. Smith.*

Second Year—

She *was* a *phantom* of delight
When first she *gleamed* upon my sight;
A lovely *apparition, sent*
To be a *moment's* ornament.—*Wordsworth.*

Third Year—

Three *years* she grew in sun and shower,
Then Nature *said* 'a *lovelier flower*
On earth *was never sown:*
This child I to *myself* will take:
She shall be *mine*, and I *will make*
A lady of my *own*.'—*Wordsworth.*

Third Monday.

First Year—

Ramped and roared the *lions*, with horrid *laughing* jaws;
They bit, they glared, *gave* blows *like beams*, a wind went with *their* paws;
With *wallowing* might and stifled *roar* they rolled on *one another.—Leigh Hunt.*

Second Year—

Soldier, rest! Thy *warfare o'er*,
Sleep the sleep *that* knows not *breaking!*
Dream of battled fields *no more*,
Days of danger, *nights* of waking.—*Scott.*

Third Year—

Through *Erin's Isle, To sport* awhile,
As Love and Valour *wandered*;
With Wit, the *sprite, Whose* quiver bright
A thousand *arrows* squandered;
Where'er they *pass*, A triple *grass*
Shoots up.—*T. Moore.*

FIRST YEAR.

1. Find the Greatest Common Measure of £176 17s. 2d.; £158 4s. 10d., and £195 9s. 6d. Ans. £9 6s. 2d.

2. If $\frac{2}{3} = \frac{4}{6}$, explain why $\frac{2+4}{3+6}$ also $= \frac{2}{3}$.

3. *Boys.*—How many yards of matting 2·4 feet broad will cover a floor that is 27·3 feet long and 20·16 feet broad? Ans. 75$\frac{1}{2}$.

Girls.—Find the price of 7,865 articles at £2 19s. 6d. each, using only one aliquot part. Ans. £23,398 7s. 6d.

4. Write in large hand the words '*Kamschatkan*,' '*Aborigines*.'

Write in small hand the words '*The mysterious melodies of popular music.*'

5. Analyse the subjoined passage, and parse the italicised words:—

Trust no future, *howe'er pleasant!*
Let the *dead Past bury* its dead.
Act, *act*, in the living *present*,
Heart within and God *o'erhead.*

6. Give one-word equivalents for the following words or phrases:—Priestly skill or cunning, a little lamb, in the direction of home, made of brass, somewhat dull, to prate frequently.

7. Describe briefly the sorrows and delights of a teacher.

8. Draw a map of British North America.

9. Enumerate, giving instances, the various kinds of river-sources.

10. Describe the manufactures of Prussia, the mineral productions of Austria, and the exports of Russia.

11. How did the Saxons raise forces for the defence of the kingdom?

12. Give the dates of Caractacus' capture, Martyrdom of Edmund, Assassination of Edward II., Death of Godwin, and of Tostig.

13. Write out Notes of a Lesson on 'Short Division.'

14. Write down two bars each of $\frac{2}{4}$ and $\frac{3}{4}$ time, OR,

Write down two measure each of two and three pulse measure.

15. Decline *bonus, -a, -um;* OR,

How do French Nouns form their plurals?

SECOND YEAR.

1. A sum of money amounts in 10 years at 3½ per cent. simple interest to £506 15s. 1½d. In how many more years will it amount to £703 16s. 6¾d.? Ans. 15 years.

2. Show that if the price in shillings of a cwt. of goods is multiplied by 3 and divided by 7, the result is the price in farthings of a lb. weight of the goods.

3. *Boys.*—The breadth of a room is 14 feet, and the cost of papering the walls at 1s. per sq. yard is £4, whilst that of carpeting the room at 4s. 6d. per sq. yard is £5 12s. Determine the height and length of the room. Ans. 12 ft.; 16 ft.

Girls.—A person buys 128 gallons of wine at 8s. 6d. per gall. How many gallons of water must he add to it in order to gain £5 12s. upon his outlay, and retail the wine at 5s. per gall.? Ans. 112 gallons.

4. As in First Year.

5. Paraphrase the subjoined lines:—

Within a long recess *there* lies a *bay*,
An island shades *it* from the rolling sea,
And *forms* a port *secure* for ships to ride;
Broke by the jutting land on *either* side,
In double streams the briny waters glide
Betwixt two rows of rocks. A sylvan scene
Appears *above*, and *groves* for ever *green*.
A grot *is formed* beneath with mossy seats
To rest the fairies and *exclude* the heats.

6. Analyse the last six lines and parse the words in italics.

7. What Intransitive or Neuter Verbs can take a Passive form?

8. Draw a map showing the mountain systems of South Western Europe.

9. What is the longitude of a place where the sun passes the Greenwich meridian three hours later than at the given place?

10. Where and what are Nancy, Sophia, Christiania, Poonah, Calicut, St. Etienne, and Stamboul?

11. How was justice administered during the Norman and Plantagenet periods?

12. Give the dates of executions of Waltheof, David of Wales, Wallace, Gaveston, and Mortimer.

13. Write out Euclid I. 10. If in the triangle PQR, PQ = RQ and RQ be produced past the vertex, so that QS = QR. Then ∧ SPR = a right angle. OR,

Describe the different methods of knitting a stocking heel.

14. Write out the Present Indicative of *bello;* OR, Six irregular French Adjectives.

15. Give combinations of manuscript letters where care must be taken in the '*joinings*.'

16. What are the signatures of the keys of A, A♭, E and E♯? OR, which are the highest and lowest notes in the following:—*Me*, in key F, *Soh*, in key C, *Doh*, in key G?

THIRD YEAR.

1. The Divisor is 4·56, and is $\frac{38}{81}$ of the Quotient, whilst the Remainder is ·49 of the Quotient. What is the Dividend? Ans. 36·5392.

2. Prove the rules for Multiplication and Division of Decimals.

3. *Boys.*—Find the respective times between 7 and 8 o'clock, when the hour and minute hands of a watch are (*a*) exactly opposite; (*b*) at right angles; (*c*) coincident.

Ans. $5\frac{5}{11}$ mins.; $54\frac{6}{11}$ mins.; $21\frac{9}{11}$ mins.; $38\frac{2}{11}$ mins. past 7.

Girls.—If a cubic foot of marble weigh 2·716 times as much as a cubic foot of water, find the weight of a block of marble 9 ft. 6 ins. long, 2 ft. 3 ins. broad, and 2 ft. thick, supposing a cubic foot of water to weigh 1,000 ozs. Ans. 3 tons 4 cwt. 3 qrs. 4 lbs. 13 ozs.

4. As in First Year.

5. Paraphrase the appended passage:—

'Where rose the mountains, there to him were friends:
Where rolled the ocean, thereon was his home;
Where a blue sky, and glowing clime extends,
He had the passion and the power to roam;
The desert, forest, cavern, breaker's foam,
Were unto him companionship; they spake
A mutual language, clearer than the tone
Of his land's tongue, which he would oft forsake,
For Nature's pages glassed by sunbeams on the lake.'

6. Explain the meaning and office of all the inflections, prefixes, and suffixes in the preceding lines.

7. What are the three chief ways in which (or some of which) Verse differs from Prose?

8. Draw a map of India.

9. Account for '*Land and Sea Breezes, Typhoons, Cyclones, and The Doldrums.*'

10. Describe the physical features of Central Africa.

11. What were the chief points at issue between the Stuarts and the Nation?

12. Give the dates of Gunpowder Plot, Petition of Right, Battle of Nantwich, Storming of Drogheda, and the Great Plague.

13. Write Notes of a Lesson to Standard VI. on the Battle of Inkerman.

14. Demonstrate Euclid I. 40. In a trapezium the straight lines drawn from the middle point of one of the non-parallel sides to the ends of the opposite side form with that side a triangle equal to half the trapezium.

What directions would you give for plain-darning a hole in stocking-web material.

15. Write out the perfect tenses of *fio*; OR, the irregularities of *Asseoir*, *Mouvoir*, and *Savoir*.

16. (*a*)

$$\frac{x-9}{3x-7} = \frac{2x-5}{6x-4} \qquad \text{Ans. } x = \frac{1}{29}$$

(*b*)

$$\frac{3-2x}{x-5} = \frac{2x-7}{4-x} \qquad \text{Ans. } x = \frac{23}{6}$$

Give directions to a servant girl upon 'lighting a fire.'

17. Find the area of a regular hexagon, each side of which is 20 feet. Ans. 1039·23 sq. ft.

How would you deal with nose-bleeding, and obstruction in the throat caused by a foreign substance?

18. Write in all the forms you know, the ascending scale of B Minor; OR, transpose a fifth higher the following passage without changing the key:—

d m s t d' d ta l m f f m fe s s d,

(*For Correspondence see end of Certificate Article.*)

SCIENCE NOTES.

THE INFLUENCE OF ELECTRIC LIGHT ON PLANT STRUCTURE.—Some experiments recently instituted by M. Bonnier with regard to the influence of exposure to the electric light on the structure of herbaceous plants give interesting results. Direct electric light appears to be prejudicial to the normal development of the tissues, its ultra-violet rays being deleterious in their action on plant structure. When plants that are growing under glass shades, by which excess of ultra-violet radiation is intercepted, are exposed continuously to electric light, considerable development simultaneously with intensification of the green coloration results, at first accompanied by high differentiation in the structure of the organs. An intense light, however, when prolonged unchanged for months causes great modifications of structure in the various tissues of such new organs as are capable of adapting themselves to the illumination. Less differentiation then occurs in these organs though they are always rich in chlorophyll.

***

A NEW PTOMAINE.—A new ptomaine has recently been extracted from pure cultures of *micrococcus tetragenus*, an organism found in the sputum of consumptives. This coccus when cultivated for several days on peptonised gelatine yields a white substance crystallising in prismatic needles, which is soluble in water and has a weak alkaline reaction. This ptomaine, which is poisonous, causing death in thirty-six hours, must be taken to be a decomposition product of the albuminoid matter in the peptonised gelatine produced during the lifetime of the microbe and during its agency.

***

THE DANGERS OF ANTIPYRIN.—The use of antipyrin as a convenient and effective remedy for nervous headache is so much on the increase that Guttmann and other authorities find it necessary to caution the public against the too frequent use of this drug, now so accessible in the form of tabloids and powders. In a recent case of a patient at the Moabit Hospital at Berlin, who was supposed to be suffering from a severe attack of cholera, it was found on inquiry that the patient had been in the habit of taking antipyrin daily as a remedy for headache. In spite of a feeling of giddiness and a disturbance of vision, the use of the drug was persevered with till ten grammes had been taken, when the symptoms manifested themselves which led to the patient's removal to the hospital Guttmann states that during the last five years numerous cases of poisoning by antipyrin have come under his notice.

***

THE ACTION OF FLUORIDES ON YEAST.—Some interesting experiments lately instituted by Dr. Baekeland as to the influence of fluorides on different varieties of yeast, give the following results: *Saccharomyces Pastorianus* seems most sensitive to the action of the fluorides, and *S. cerivisiæ* to have the most resisting power. If fluoride be added to yeast in the proportion of from one part in two thousand parts to one part in three thousand parts, yeasts can be kept for more than six months. At the end of that time they will still develop rapidly, and produce a splendid fermentation.

***

THE FORMATION OF CARBO-HYDRATES BY PLANTS.—A series of experiments instituted by Bokorny furnishes a fresh argument in favour of the view that formic aldehyde is the first product in the formation of starch and other carbo-hydrates by plants. Specimens of *Spirogyra nitida* and *S. majuscula* were entirely deprived of starch by the addition to the water of a small quantity of calcium nitrate and magnesium sulphate, and were then fed with formic aldehyde. This substance, however, being itself injurious to vegetation, even when found in very small quantities, its place was taken by sodium formic aldehyde, a salt which readily breaks up into formic aldehyde and sodium sulphite. Starch was then rapidly formed in the chlorophyll bodies in the filaments of *Spirogyra*.

***

THE BANANA AS A FOOD PRODUCT.—In a recent report read before the Australasian Association for the Advancement of Science, Mr. Doherty, the Assistant Government Analyst of New South Wales, combats the common opinion that the banana forms a perfect food for man. His analysis of picked specimens of the Cavendish or Fiji variety, which is the kind chiefly in demand in Australia, shows that while this fruit is a really valuable addition to a diet rich in nitrogenous substances, the small quantity of albuminoids it contains makes its use as a sole article of diet inadvisable. Fifteen pounds weight of bananas would have to be consumed daily to furnish the quantity (4·2 ounces) of flesh-forming substances required by an average man under normal conditions, and this amount of the fruit would contain nine pints of water.

***

THE ACTION OF ALKALOIDS ON LEUCOCYTES.—Considerable importance attaches to the experiments of Dr. E. Maurel determining the action of alkaloids on leucocytes. Sulphate of strychnine is found to cause the death of the leucocytes and of the animal simultaneously. The spontaneous activity of the white corpuscles is arrested as the immediate effect of the poison, and they are fixed in the spherical state. There is also a complete concordance between the quantity necessary to kill the animal and the leucocytes in the case of atropine. Pilocarpine and atropine are mutually antidotal in their effect, for when mixed together in the proportions of their respective toxicities and added to the blood they prove inoffensive to the leucocytes. Death by cocaine Dr. Maurel asserts to be the result of the death or modifications of the leucocytes.

***

CHEMICAL ANALYSIS AND PALÆONTOLOGY.—Chemical analysis has recently received a novel application in the researches of M. Carnot into the age of prehistoric human remains. Taking the progressive diminution of fluorine in the fossil bones of successive geological ages as a starting point, he would represent the proportion found in the oldest specimens by 1, that of the tertiary remains by 0·64, that of the quaternary by 0·35, and that of the more recent bones by 0·05 or 0·06. The value of these figures was tested on the discovery of a human tibia at Billancourt (Seine), near some animal remains of the quaternary period. The question arose whether the tibia was of the same age as the other fragments or not, a question M. Carnot was able to answer in the negative, for on analysis the proportion of fluorine in the animal bones was found to vary from 0·469 to 0·578 as compared with 0·066 in the human tibia.

***

DR. NANSEN AS AN ANATOMIST.—Dr. Nansen, who is now preparing for the Arctic exploration, a sketch of the scope of which has been given in these columns, is an anatomist of considerable note. He has made a special study of the construction of the central nerve-system, particularly the question of the nerve cells and nerve roots, completing in this direction the researches of Golgi.

THE PREPARATION OF BOUILLIE BORDELAISE.—A formula for the preparation of *bouillie bordelaise*, the French specific for the potato blight, to which we have directed attention in these columns, is given by the authorities at Kew. To prepare a sufficient quantity for one acre of land, forty-five pounds of copper sulphate are dissolved by suspension in a coarse cloth in a wooden vessel containing 220 gallons of water. Twenty-two and a half pounds of quicklime are then slaked in a separate vessel, and after being thoroughly stirred with added water, are passed through a sieve into the copper solution to which, when well stirred, the remaining water is added. *Bouillie bordelaise* forms the best remedy for the ravages of *Phytophthora infestans* at present known to science. It is interesting to notice in this connection that a potato disease has recently made its appearance in several districts in the Presidency of Bengal, which is quite distinct from that caused by *Phytophthora infestans*. The opinion is advanced that it closely resembles the disease caused by *Peronospora trichotoma* on *Colocasia antiquorum*, an edible corm or yam grown in Jamaica.

—o—

THE 1893 SCHOLARSHIP EXAMINATION.

BY DR. GEORGE BEACH, M.A.,

Co-Author of 'A Manual of our Mother Tongue,' 'A Girls' Arithmetic,' Author of 'Elements of English,' 'Entertaining Readers,' etc.

I. LIST OF RESIDENTIAL AND DAY TRAINING COLLEGES UNDER INSPECTION.

Name of Training College.	Name and Address of Correspondent.
For Masters only. (22.)	
RESIDENTIAL COLLEGES.	
Bangor (British and Foreign School Society's) - -	Rev. D. Rowlands, Bangor.
Battersea (National Society's) -	Rev. Canon Daniel, Battersea, London, S.W.
Borough Road (British and Foreign School Society's) -	A. Bourne, Esq., Borough Road Training College, Spring Grove, Isleworth.
Carmarthen (National Society's)	Rev. C. G. Brown, Carmarthen.
Carnarvon (Church of England)	Rev. J. Fairchild, Carnarvon.
Chelsea, St. Mark's (National Society's) - - - - -	Rev. G. W. Gent, St. Mark's Training College, Chelsea, London, S.W.
Cheltenham (Church of England) - - - - -	Rev. R. M. Chamney, Cheltenham.
Chester (Chester, Manchester, and Liverpool Diocesan) -	Rev. A. P. Holme, Rectory, Tattenhall, Chester.
Culham (Oxford Diocesan) -	Rev. W. S. F. Long, Culham, Abingdon.
Durham (Diocesan) - - -	Rev S. B. Smith, Training College, Durham.
Exeter (Diocesan) - - -	Rev. Dr. Dangar, Exeter.
Hammersmith, St. Mary's (Roman Catholic) - - -	Rev. T. Graham, Brook Green House, Hammersmith, London, W.
Peterborough (Church of England) - - - - -	Rev. C. Daymond, Peterborough.
Saltley (Worcester Diocesan) -	Rev. F. W. Burbidge, Saltley, Birmingham.
Westminster (Wesleyan) - -	Rev. Dr. Waller, Wesleyan Training College, Horseferry Road, Westminster, London, S.W.
Winchester (Diocesan) - -	Rev. H. Martin, Training College, Winchester.
York and Ripon (Diocesan) -	Rev. G. W. de C. Baldwin, York.
DAY COLLEGES.	
Cambridge (Cambridge) - -	Oscar Browning, Esq., King's College, Cambridge.
Leeds (Yorkshire College) -	N. Bodington, Esq., Yorkshire College, Leeds.
Liverpool (University College)	F. S. Carey, Esq., University College, Liverpool.
London (King's College) - -	J. W. Cunningham, Esq., King's College, Strand, W.C.
Manchester (Owen's College) -	A. W. Ward, Esq., Owen's College, Manchester.
For Mistresses only. (26.)	
RESIDENTIAL COLLEGES.	
Bishop's Stortford (St. Albans Diocesan) - - - - -	Rev. W. J. Frere, Hockerill, Bishop's Stortford.
Brighton (Chichester Diocesan) -	Rev. G. Corfield, Training College, Brighton.
Bristol, Gloucester, and Oxford (Diocesan) - - - - -	Rev. H. Proctor, Fishponds, Bristol.
Cheltenham (Church of England) - - - - - -	Rev. R. M. Chamney, Cheltenham.
Chichester (Bishop Otter's Memorial) - - - - -	Miss Trevor, Bishop Otter's Memorial College, Chichester.
Darlington (British and Foreign School Society's) - - -	W. A. Spafford, Esq., Training College, Darlington.
Derby (Lichfield Diocesan) -	Rev. A. E. Vinter, Training College, Derby.
Durham (Diocesan) - - -	Rev. J. Haworth, Durham.
Edge Hill - - - - -	Thomas C. Ryley, Esq., Training College, Durning Road, Edge Hill, Liverpool.
Gray's Inn Road (Home and Colonial School Society's) -	G. H. Sawtell, Esq., Gray's Inn Road, London, W.C.
Lincoln (Diocesan) - - -	Rev. Hector Nelson, Lincoln.
Liverpool Roman Catholic -	Miss Lescher, Roman Catholic Training College, 96, Mount Pleasant, Liverpool.
Norwich (Diocesan) - - -	Rev. T. Archbold, Norwich.
Oxford (Diocesan) - - -	Rev. H. D. De Brisay, Bradmore Road, Oxford.
Ripon (York and Ripon Diocesan) - - - - - -	Rev. E. B. Badcock, Ripon.
Saffron Walden - - - -	A. Bourne, Esq., Training College, Saffron Walden.
Salisbury (Diocesan) - -	Rev. E. Steward, The Close, Salisbury.
Southlands, Battersea (Wesleyan) - - - - - -	Rev. Dr. Greeves, The College, Southlands, Battersea, London, S.W.
*Stockwell (British and Foreign School Society's) - - -	A. Bourne, Esq., Training College, Stockwell Road, London, S.W.
Swansea (British and Foreign School Society's) - - -	D. Salmon, Esq., Training College, Swansea.
Tottenham (Christian Knowledge and National Societies') - - - - - -	Rev. E. Hobson, Training College, Tottenham, London.
Truro (Exeter Diocesan) - -	The Ven. Archdeacon Cornish, Training College, Truro.
Wandsworth (Roman Catholic) -	Madame Moran, Training College, West Hill, Wandsworth, London, S.W.
Warrington (Chester, Manchester, and Liverpool Diocesan) - - - - - -	The Very Rev. The Dean of Manchester, Training College, Warrington.
*Whitelands (National Society's) - - - - - -	Rev. J. P. Faunthorpe, Whitelands House, Chelsea, London, S.W.

* Residential Colleges taking Day Students.

DAY COLLEGE.

Birmingham (Mason Science College) - - - -	Rev. E. F. M. MacCarthy, 180, Hagley Road, Birmingham.

For both Masters and Mistresses. (5.)

RESIDENTIAL COLLEGE.

Homerton (Undenominational) -	J. C. Horobin, Esq., The College, Homerton, London, N.E.

DAY COLLEGES.

Cardiff (University College of South Wales and Monmouthshire) - - - - -	Ivor James, Esq., University College of South Wales, Cardiff.
Newcastle-on-Tyne (Durham College of Science) - -	H. F. Stockdale, Esq., Durham College of Science, Newcastle-on-Tyne.
Nottingham (University College) - - - - -	Rev. J. E. Symes, University College, Nottingham.
Sheffield (Firth College) - -	E. Drury, Esq., Firth College, Sheffield.

We give the above list in compliance with many requests, but we cannot undertake to give more than general advice with regard to the selection of a college.

Often we are requested to arrange the various colleges according to our opinion of their order of merit; but this we invariably decline to do, because (*a*) it would be an assumption on our part, and (*b*) it would be drawing invidious distinctions.

Only one remark would we here make, viz., that although naturally there is a rush for places in the metropolitan training colleges, it by no means follows that the London institutions are the best suited for all students. Our own *alma mater* (chosen in preference to the London college at which we sat for the Scholarship Examination) is Carmarthen, and we have never regretted the selection. Many other school-teachers more famed or notorious than ourselves, hail from provincial training colleges.

The best college wherein to enter is the one that will admit you.

II. DOMESTIC ECONOMY (*continued from p.* 189). Summary of Questions given in last twenty years.

SECTION III.—(*a*) *Ingredients of Food, etc.*

The chief purposes of food; Typical foods; Classes of foods; Needs of the bodies of children and adults; Variations of food according to occupation; Temperature of body; Flesh, fish, and vegetable diets; *Cost of food;* Effect on body of carbon, sugar, lime, salt, oil, stimulants; The special properties and constituents of water, *milk*, beer, ordinary vegetables, cereals, sago, tapioca, *arrowroot, eggs, cheese, fish*, and *lean beef*; The quantity of water in ordinary foods.

(*b*) *Preparation of Food, etc.*

The objects of cooking; Cooking utensils; The Oven; *Methods of Cooking*, with the time required for joints of various weights; *The applicability, advantages, and disadvantages of the various modes; The concoction of simple gravies and sauces;* The making of tea and coffee; *How to cook fish, potatoes, green vegetables, poultry, and butcher's meat;* Recipes for oatmeal porridge, barley water, *beef tea*, mutton broth, ordinary soup, *pea soup*, potato pie, *rice pudding*, plum pudding, and batter pudding; *How to make bread;* The manufacture of cheese and butter; *Utilisation of scraps of meat, bread, dripping, and waste products in general;* Employment of condiments; Hot versus cold foods; Why are the French better cooks than we? Series of dinners for lone teachers; How to test the condition and genuineness of foods; *How to preserve foods.*

SECTION IV.—(*a*) *Health.*

Influence of habits upon health; *Simple rules for the preservation of health:* Effect of equable temper upon health; Sensible clothing; *Evils of fashionable clothing; Danger when schoolroom is also cloakroom;* Evil of damp clothing; Importance of physical training, regular exercise, and special exercises for infants and girls; Supervision of playground sports; Early rising; *Evils of flat desks; Personal cleanliness; Cleanliness of premises;* Temperature and fixing of baths; Lighting, Ventilating, and Drainage of premises; *Evils of impure air;* Description of respiration; Practices interfering with respiration.

(*b*) *Sickness, etc.*

Making of linseed and other poultices; *Cases of emergency, such as burns, scalds, drinking boiling water, cuts, choking, stunning, fainting, convulsions, and sprains; Improvisation of a stretcher;* Antidotes to ordinary poisons; *Symptoms and first treatment of whooping cough, measles, croup, smallpox, ring-worm, typhus fever, and scarlatina; Precautions against infection and contagion;* Disinfectants.

Nursing of convalescents, Emetics and aperients.

The more frequently recurring questions are given in italics.

(*To be continued.*)

III. ALGEBRA.

Factorising:—

(*a*) All the ordinary formulae such as $(a+b)(a-b)=a^2-b^2$, $a^4+a^2b^2+b^4=(a^2+ab+b^2)(a^2-ab+b^2)$, and the ordinary powers of binomials should be well known.

(*b*) Note also that—

$$\frac{a^3+b^3}{a+b}=a^2-ab+b^2$$

$$\frac{a^5+b^5}{a+b}=a^4-a^3b+a^2b^2-ab^3+b^4$$

$$\frac{a^7+b^7}{a+b}=a^6-a^5b+a^4b^2-a^3b^3+a^2b^4-ab^5+b^6$$

(*c*) Note also that—

$$\frac{a^3-b^3}{a-b}=a^2+ab+b^2$$

$$\frac{a^5-b^5}{a-b}=a^4+a^3b+a^2b^2+ab^3b^4$$

$$\frac{a^7-b^7}{a-b}=a^6+a^5b+a^4b^2+a^3b^3+a^2b^4+ab^5+b^6$$

(*d*) It is often forgotten that x^{2n} is always a square whatever n may be; for it $=(x^n)^2$. Thus x^8, x^6, x^4, x^2 are all squares respectively of x^4, x^3, x^2, x.

$x^6-x^4=(x^4+x^2)(x^4-x^2)=x^2(x^2+1)\,x^2(x^2-1)=x^4(x^2+1)(x+1)(x-1)$

(*e*) x^{3n} is always a cube, whatever n may be, for it $=(x^n)^3$. Thus x^{12}, x^9, x^6, x^3 are all cubes respectively of x^4, x^3, x^2, x.

$x^{12}-x^6=x^6(x^6-1)=x^6(x^3+1)(x^3-1)=x^6(x+1)(x^2-x+1)(x-1)(x^2+x+1)$.

(*f*) $24x^2+46xy+21y^2=24x^2+18xy+28xy+21y^2=6x(4x+3y)+7y(4x+3y)=(6x+7y)(4x+3y)$.

In such an example the difficulty is to break up the middle coefficient into two parts such that the first coefficient is to the first part, as the other part is to the third coefficient. Thus 24 : 18 as 28 : 21, viz., as 4 : 3.

General Example. $ax^2+bxy+cy$.

Let m and n be the required parts of b.

Then $\frac{a}{m}=\frac{n}{c}$ and $ac=mn$.

Now we have $ac=mn$ and $b=m+n$

$\therefore\ m=\frac{ac}{n}$ and $m=b-n$

$\therefore\ \frac{ac}{n}=b-n$; $n^2-nb=-ac$, from which n can be found and afterwards m.

Practically, however, the quadratic solution is generally unneces-

sary, for, by inspection or trial, two numbers m and n can be found whose sum is = to b and product = to ac.

In resolving $6x^2 + 17xy + 12y^2$, $mn = ac = 72$, and $m + n = 17$.

By inspection therefore $m = 9$, $n = 8$, and we proceed as follows :—

$6x^2 + 17xy + 12y^2 = 6x^2 + 9xy + 8xy + 12y^2 = 3x\ (2x + 3y) + 4y\ (2x + 3y) = (3x + 4y)\ (2x + 3y)$.

When a and c and b are large numbers, they can still be easily found by trial, if we remember that the sum of the factors of a given number is the least when these factors are equal, and that the greater the difference between the factors the greater is their sum.

Thus the factors of 36 ranged in order of difference are 6×6, 9×4, 12×3, 18×2, 36×1, and the sums of these factors will be in the ascending order 12, 13, 15, 20, 37.

So that if we take factors of ac which are inadmissible through their sum being greater than b we have to choose other factors which approximate more nearly to each other and to the square root of ac.

If the sum of the factors be less than b, we must choose other factors which differ more greatly from each other and the square root of ac.

IV. *To sew on flannel binding* (inserted by request).

(*a*) The binding should be neatly hemmed or run on to the right side of the flannel. Then the process should be repeated in exactly the same manner on the wrong side, care being taken that the stitches do not show through. It will be obvious that the binding must reach exactly half its width on each side of the flannel edge.

(*b*) *A round corner.* The binding must be slightly fulled round, or 'eased on' round the corner and made to correspond exactly at the back.

(*c*) *A square corner.* Sew straight to the corner, then with the thumb hold the binding ready for next side. Next, carefully fold under the superfluous binding until a fold is made straight from the corner and coming exactly between the sides of the flannel making an angle of 45 deg. with each.

V.—SCHOLARSHIP RESULTS.

Year.	Sexes.	Sat for Exam.	Failures.		Passes.							
					1st Class.		2nd Class.		3rd Class.		Total.	
			No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
1891	Boys ..	3094	1212	39	488	16	1053	34	341	11	1882	71
	Girls ..	7900	2724	34½	1491	19	2887	36½	798	10	5176	65½
	Total ..	10994	3936	36	1979	18	3940	36	1139	10	7058	64
1892	Boys ..	3096	842	27	474	15½	1315	42½	465	15	2254	73
	Girls ..	7730	1964	25½	1397	18	2454	31½	1915	25	5766	74½
	Total ..	10826	2806	26	1871	17	3769	35	2380	22	8020	74

VI.—CORRECTION.—Page 191, Sum 17, read £164 instead of £1164.

VII.—The Sun of Christmas casts its rays in advance of its rising, and in order not unduly to cloud the light of holidays, we set no work for the fourth week of December.

May the honest study of the last six months enhance the Christmas joy of all our readers, to whom, in no conventional manner, we wish

A MERRY CHRISTMAS,
and
A HAPPY SCHOLARSHIP YEAR.

SELECTED SCHOLARSHIP QUESTIONS.

WEEK ENDING 10TH DECEMBER, 1892.

1. Give instances of words which have changed their meaning since they were first introduced into the language; and of words introduced within the present century.

2. State the requirements of the Code under the head of '*English*' in Standard III. Show how the lessons may be utilised so as to teach the children to frame sentences and speak correctly.

3. (*a*) State, with diagrams, the relative positions of the sun, the moon, and the earth during an eclipse of the sun and during an eclipse of the moon.

(*b*) Why is there not an eclipse whenever there is *full moon* and *new moon*?

4. Describe the population of the United States with reference to race and occupation.

5. Name the chief events in the reign of Charles II., and give the character of that king.

6. At what dates and under what circumstances did (*a*) *Ceylon*, (*b*) *Jamaica*, (*c*) *Gibraltar*, (*d*) the Channel Islands become part of the British Empire?

7. Describe the method you adopt in teaching *Singing by note* to a class of beginners.

8. In giving a lesson on a River, which is the better plan—to speak first of a particular river which the children have seen, or to start with a definition and a general description? Give reasons for your opinion.

9. Mention the flats and sharps in the order of their introduction into the keys; OR

Write the pulse-signs for four different kinds of measure.

10. Say how would you *prove* to a class of children that :—

(*a*) Five times six is the same as six times five:

(*b*) One-seventh of three is the same as three-sevenths of one :

(*c*) If A is $\frac{2}{3}$ B, B is $\frac{3}{4}$ of A.

11. If 18 pumps can raise 2,150 tons of water in 10 days, working 7 hours a day, in how many days will 16 pumps raise 1,634 tons working 9 hours a day? Ans. $6\frac{1}{18}$ days or $59\frac{7}{18}$ hours.

12. If I must hire 2 men and 3 boys for 6 days to do the same piece of work as 11 men and 5 boys could do in $1\frac{1}{2}$ days, compare the work of a boy with that of a man. Ans. As 3 : 7.

13. (*Men only.*) Write out Euclid I. 26.

The straight lines which join the points of intersection of the diagonals of the squares described on the sides of a parallelogram form a square.

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR **DECEMBER**, 1892. (MEN AND WOMEN.)

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.
	I.	II.	III.	I.	II.	III.	I.	II.	III.	
MONDAY	Algebra up to Factors, *or* Questions on Needlework	History from 1760 to 1773	Latin, *or* French Grammar	H.C.F. of Algebra, *or* Ingredients of Food	Dates from 1760 to 1787	Pages 29 to 34 of 'La Jeune Sibérienne,' *or* Chapters 21 to 25 of 'De Bello Gallico'	Algebraic Fractions, *or* Rules of Health	History from 1787 to 1807	Latin, *or* French Grammar	HOLIDAY.
TUESDAY	Props. 12 and 13 of Euclid, Book II. *or* Diagram of Night Shirt	Physical Geography of South America	Science, *or* Revision	Props. 14, 1 and 2 of Euclid, Book II., *or* Flannel Sampler	Revise Geography of Scotland	Science, *or* Revision	Props. 3 and 4 of Euclid, Book II., *or* Calico Sampler	Political Geography of South America	Science, *or* Revision	
WEDNESDAY	Percentages and Repetition	History of English Language	Drawing, *or* Revision	Stocks	Paraphrasing and Repetition	Drawing, *or* Revision	Square Root	Table of English Literature	Drawing, *or* Revision	
THURSDAY	H.C.F. (G.C.M.) of Algebra, *or* Savings and Investments	History from 1773 to 1787	Pages 24 to 29 of 'La Jeune Sibérienne,' *or* Chapters 17 to 21 of 'De Bello Gallico'	G.C.M. of Algebra, *or* Preparation of Food	England under the Normans	Latin, *or* French Grammar	Algebraic Fractions, *or* Clothing and Washing	History from 1807 to 1819	Pages 34 to 39 of 'La Jeune Sibérienne,' *or* Chapters 25 to 30 of 'De Bello Gallico'	
FRIDAY	Revise Props. 32 to 48 of Euclid, Book I., *or* Calico Sampler	Physical Geography of South America	Stocks	Deductions on Euclid, Book II. *or* Diagram of Night Shirt	Map of Australia	Mensuration of the Circle, *or* Mixtures	Revise Props. 1 to 16 of Euclid, Book I., *or* Flannel Sampler	Political Geography of South America	Equation of Payments	
SATURDAY	How to teach Grammar to Standard V.	Parsing and Analysis	Examination	Notes of a Lesson on Standard VI. Geography	Study English Accidence from Text Book	Examination	Music	Parsing and Analysis	Examination	

(*Women only.*) On what grounds can a diet consisting wholly of vegetable food be defended? What objections to it can be fairly urged, and to persons of what class or age are such objections applicable?

14. (*Men only.*) Write out Euclid II. 7.

If a straight line, AB, be bisected in C and produced to D, so that the square on AD is twice the square on CD, prove that the square on AB is twice the square on BD.

(*Women only.*) Describe fully the process of making bread, the materials to be employed, the time to be occupied in the process, and the appliances needed.

15. (*Men only.*) Show that the area of a triangle, whose sides are 26, 35, 51, is the same as the area of a right-angled triangle, whose sides about the right angle are 7 and 120. Ans. 420 each.

(*Women only.*) What are the chief purposes to be served by taking food? Name several articles of food which are respectively suited to fulfil each of these several purposes.

16. (*Men only.*) Solve—

$$\left.\begin{aligned} 5x - 6y + 4z &= 15 \\ 7x + 4y - 3z &= 19 \\ 2x + y + 6z &= 46 \end{aligned}\right\}$$ Ans. $x = 3, y = 4, z = 6.$

17. (*Men only.*) Find the highest common factor of—

$$7x^4 - 10x^3 + 3x^2 - 4x + 4 \text{ and}$$
$$8x^4 - 13x^3 + 5x^2 - 3x + 3$$

Ans. $x^2 - 2x + 1.$

WEEK ENDING 17TH DECEMBER, 1892.

1. Paraphrase this passage:—

'Twas
Sternly and *sadly heard*
As *it* quenched the woodfire's glow,
Which had cheered the board with the mirthful word
And the red *wine's* foaming *flow:*
Until that sullen boding knell,
Flung out from every fane,
On harp, and lip, and spirit, *fell*
With a weight and with a chain.

And parse the words in italics.

2. From each of the words, *joy, glory, true, wise,* form three other words by the addition of a suffix, introducing each word into a short sentence.

3. Give the full meanings of the terms *tropic, meridian, longitude, solstice, coral reefs,* with appropriate diagrams in each case.

4. What information would you give in a lesson on the mountains and plains of Europe?

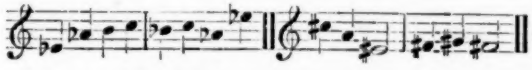
5. (*a*) In what parts of Britain did the *Saxons,* the *Angles,* and the *Jutes* settle? (*b*) What were the chief battles fought by Alfred against the Danes? (*c*) Trace the descent of Edward the Confessor from Egbert.

6. Write an account of the character of King Edward the Third, and mention the leading events of his reign.

7. What is an Object Lesson? Show that mere sight is not necessarily knowledge.

8. What are the best expedients you know for reviving the attention of a languid or disorderly class?

9. State the key of each of the following passages:—



OR

Name the following relations of the *lah* or minor mode:—(*a*) Dominant, (*b*) Minor or essential sixth, (*c*) Leading-note or essential seventh, and (*d*) Supertonic.

10. (*Men only.*) The diagonal of a square field is 1,000 links. Find its area in acres. Ans. 5 acres.

(*Women only.*) Reduce to a simple form $\frac{2\frac{1}{5} \times \frac{13}{61}}{\frac{8}{7} \times 1\frac{3}{17}} \div \frac{1\frac{3}{5} \times \frac{11}{16}}{\frac{9}{13} \times 1\frac{8}{17}}$.

Ans. $\frac{7}{11}$.

11. If £150 will support a family of 8 persons for 10 months, for how many months would £120 support a family of 5 persons? Ans. $12\frac{1}{2}$ months.

12. (*Men only.*) Write out Euclid I. 30.

Find the locus of the middle points of the straight lines drawn to a given straight line from a given point without it.

(*Women only.*) What are the special advantages of fish as an article of food?

13. (*Men only.*) Write out Euclid II. 9.

Divide a given straight line into two parts, such that their rectangle may be equal to a given square.

(*Women only.*) How would the sum of £20 be most properly expended in furnishing a labourer's cottage containing three rooms?

14. (*Men only.*) The circumference of a circular field is 252 yards. If the field be worth £48 16s., find the value of a similar circular field whose circumference is 315 yards. Ans. £76 5s.

(*Women only.*) Give an exact statement of all the materials required, with the amount and cost of each, for the complete winter outfit of a girl of the artisan class aged ten. Add up the total cost.

15. (*Men only.*) Simplify

$$\frac{\frac{x}{y} - 1 + \frac{y}{x}}{\frac{x}{y} + 1 + \frac{y}{x}} \times \frac{\left(\frac{x}{y}\right)^3 - 1}{1 + \left(\frac{x}{y}\right)^3} \times \frac{y^2 + xy}{x^2 - xy}.$$

Ans. $\frac{x^2}{y^2}$

16. (*Men only.*) Solve

$$\left.\begin{aligned} \frac{m}{x} + \frac{n}{y} &= 1 \\ \frac{n}{x} + \frac{m}{y} &= 1 \end{aligned}\right\}$$ Ans. $x = y = m + n.$

WEEK ENDING 24TH DECEMBER, 1892.

1. Write out in order of Prose the following passage:—

In every village marked with little spire,
Embowered in trees and hardly known to fame,
There dwells, in lonely shed and mean attire,
A matron old, whom we Schoolmistress name;
Who boasts unruly brats with birch to tame.
They grieven sore, in piteous durance pent,
Awed by the power of this relentless dame;
And oft-times on vagaries idly bent
For unkempt hair, or task unconned are sorely shent.

2. Explain as to Standard VI. the meaning of a *Noun Sentence,* and write four short passages, each containing one.

3. Draw an outline map, giving lines of latitude and longtitude, of '*The Basin of the Mississippi.*'

4. Explain and illustrate by a diagram the variation in the length of day and night.

5. Give a short sketch of the Norman Conquest.

6. What do you know of Margaret, the Maid of Norway; the Battle of Pinkie; and the Rye House Plot?

7. Name any poems or verses which you would choose to be learned by heart, *either* (*a*) by infants, or (*b*) by scholars in the Sixth Standard. Say what is the use of memory exercises of this kind.

8. After explaining to a class the effect of mountain ranges upon climate, show how you might lead the children to seek further proofs for themselves.

9. Explain the following terms:—Adagio, Crescendo, Lento, Allegro, Ritard, Legato.

10. Find the least number which, if multiplied by 43 and divided by 41, leaves a remainder of 18. Ans. 9.

11. Two pint measures are filled with milk and water; in one the ratio of milk to water is 6 : 1, in the other 7 : 1. If the contents of each be emptied into a quart measure, find the ratio of milk to water in it. Ans. 97 : 15.

12. A gallon of pure water weighs 10 lbs. avoirdupois. Find the weight of 16 gallons of olive oil, 1 gallon of oil weighing ·915 gallons of water. Ans. 1 cwt. $34\frac{3}{4}$ lbs.

13. (*Men only.*) Write out Euclid I. 33.

Construct a parallelogram having given two diagonals and the angle between them.

(*Women only.*) Give directions for roasting a piece of beef. Say by what signs you would know when it was properly cooked. How would you make the gravy?

14. (*Men only.*) Write out Euclid II. 9.

Give the algebraic equivalents of the first nine propositions.

(*Women only.*) How would you make a linseed poultice?

15. (*Men only.*) The sides of a field A, B, C, D taken in order are 28, 45, 60 and 57 yards, the angle ABC being a right angle. Find

the area of the field in square yards correct to two places of decimals. Ans. 2,009·85 sq. yards.

(*Women only.*) What is meant by respiration? Describe the process and the use of it. Say also what common practices interfere with proper respiration, and how such practices may be corrected.

16. (*Men only.*) Prove that if c be a common measure of a and b, it will also measure $ma \pm nb$. Find the G. C. M. of $6x^3 - 10x^2 + 10x - 4$ and $9x^3 + 3x^2 + 3x - 6$. Ans. $3x - 2$.

17. (*Men only.*) Prove the rule for dividing one fraction by another.

Simplify $\left(\frac{1}{m} + \frac{1}{n}\right)\left(a + b\right) - \left(\frac{a+b}{m} - \frac{a-b}{n}\right)$

Ans. $\frac{2a}{n}$

(*For Correspondence see end of Certificate Article.*)

—o—

THE 1892 CERTIFICATE EXAMINATION.

BY DR. GEORGE BEACH, M.A.,

Co-Author of 'A Manual of our Mother Tongue,' 'A Girls' Arithmetic,' Author of 'Elements of English,' 'Entertaining Readers,' etc.

First Year.

(*a*) *Men.* Analyse from Essay XXI., 'There is surely no greater wisdom . . . than to keep too long a watch upon their approaches.' Parse *there, surely, no, than, to time, light, if, light, forced, nay, were, to meet, nothing, odds.*

(*b*) *Women.* Analyse from 'Tintern Abbey,' lines 134 to 146. Parse *therefore, let, be, to blow, when, matured, mansion, as, oh, then, portion, thou remember.*

(*c*) *Men.* Analyse from 'Lay of Last Minstrel,' Stanza 18, Canto VI. Parse *soon, high, light, to gleam, forms, indistinct, dream, till, room, part, placed, part.*

(*d*) *Women.* Analyse from 'Ode on Immortality,' lines 149 to 160. Parse *recollections, which, be, what, are, yet, light, seeing, have, to make, seem, being, truths, neither, can, destroy.*

(*e*) *Men.* Analyse from Essay XI., 'In the discharge of thy place set before thee . . . have carried themselves ill in the same place.' Parse *set, thee, for, globe, own, thyself, whether, best, also, that, ill, same.*

(*f*) *Women.* Analyse from 'Resolution and Independence,' Stanza 18. Parse *smile, his, words, repeat, that, gathering, wide, stirring, thus, waters, were, could, long, still, may.* (Fourth Monday.)

Second Year.

(*a*) *Men.* Analyse from Essay XXV., 'Above all things order and distribution . . . and an unreasonable motion is but beating the air.' Parse *singling, out, is, so, as, be, subtile, for, that, divide, divideth, much, out of, is, but, beating.*

(*b*) *Woman.* Analyse from 'King Lear,' Scene 3, Act III., Lines 17 to 25. Parse *though, as, less, me, master, be relieved, some, thing, forbid, the, shall, too, deserving, must, that, when.*

(*c*) Parse *know, what, to think, if, me, sepulchring, O, are, time, that, sister's, naught, like, vulture, here, scarce, believe, how.* (Third Friday.)

(*d*) *Men.* Paraphrase from Essay XIX. 'For their Commons, there is little danger from them . . . are things of defence and no danger.'

II. Grammatical Peculiarities of 'King Lear.' (*Continued* from p. 199.)

[The lines are denoted by the numbering of the *Globe* edition.]

Redundant Objective—
'I know *you* what you are.'—I., i., 272.

Redundant Words—
'Return those duties *back*.—I., i., 99.
'*From* whence I will fitly bring you.'—I., ii., 184.
See also II., i., 126; V., i., 20 (*be-*); IV., vi., 71 (*en-*).

Transposition of Adjectives—
'A *secretary astronomical*.'—I., ii., 164

Agglutinous Adjective—
'The *to-and-fro-conflicting* wind.'—III., i., 11.
'*One-trunk-inheriting* slave.'—II., ii., 20.

Hybrid Adjective—
'And quench the *stelled* fires.'—III., vii., 61.

Compound Adjectives—
'Child-changed father.'—IV., vii., 17.
(See also Moffatt's 'King Lear,' p. 160.)

Adjective used as Noun—
'All *cruels* else subscribed.'—III., vii., 65.
(See also Plural Adjectives.)

Be- (verbalising)—
'*Be*monster.'—IV., ii., 63.
'*Be*sort.'—I., iv., 272.
'*Be*madding.'—III., i., 38.

Be- (rendering intransitive verbs transitive)—
'*Be*weep.'—I., iv., 324.

Be (redundant)—
'*Be*met.'—V., i., 20.

Dis- = un-
'A little to disquantity your train.'—I., iv., 270.

For- = injury—
'She *fordid* herself.'—V., iii. 255.
C.f., *forbid, foreclose.*

Un- versus *in-* or *non-*
(*Non-* only occurs twice in all Shakespere's plays.)
'*Un*firm and choleric years.'—I., i., 304.

-Er = agent. (Obsolete use)—
'Justic*ers*.'—IV., ii., 79.

-Less—
'Your great oppose*less* wills.'—IV., vi., 38.

Emphatic accents on unemphatic syllables—
'The ín | jur-*iés* | that théy | them-selvés | pro-cur'e.' | —II., iv., 303.
'To bríng | but five | and twen | -ty; *tó* | no móre.' | —II., iv., 251.
''Vaunt coúr | -iers *tó* | oak-cléav | -ing thún | -der-bolt's.' | —III., ii., 25.
'Came thén | in-*to* | my min'd, | and yét | my mind.' | —IV., i., 36.

Two extra unemphatic syllables—
'Per-úse | this letter. | No-thíng | al-móst | sees *mir'acles*.' | —II., ii., 172.
'Must b'e | a faíth | that réa | -son with | -out *mir'acle*.' | —I., i., 225.
'I dar'e | a-voúch | it, sir'. | What, f'if | -ty *follow'ers*.' | —II., iv., 240.
'That hé | sus-pécts | none; ón | whose fool | -ish *hon'esty*.' | —I., ii., 197.
'The r'eg | -ion óf | my heárt, | be Ként | un-*man'nerly*.' | I., i., 147.
'As yóu | are old | and *rev'erend*, | you shoúld | be wise.' | —I., iv., 261.

(*a*) *Contractions. Dropped Prefixes*—
(be) *nighted*.—IV., v., 13.
(ap) *parel*.—IV., i., 51.
(*com*) plain.—III., i., 39.

(*b*) *This* = *this is*—
'This' á | good bloc'k' | —IV., vi., 187.

(*c*) *In pronunciation*—
'I have | cast of'f | for *éver;* | thou shal't | I *warrant* thee.' —I., iv., 332.
'Wh'ither is | he *g'oing?*' | —II., iv., 299.
'Ju-dí | cious *púnish* | ment! 'Tw'as | this flésh | begót.' —III., iv., 76.
'Hold thée, | from thís, | for *ev'er*. | The bárb | -*arous* Scythian. —I., i., 118.
'The méss | -*engers* fróm | our sís | -ter an'd | the king.' —II., ii., 54.

Especially note the contracted pronunciation of final polysyllabic names—
'What ít | contáins. | If yóu | shall sée | *Cordélia*.'—III., i., 46.
Also V., iii., 20 and 245; I., i., 43; v., i., 60.

Lengthening of Words—

'Sir' you | speak n'o | *-b(e)ly'.'* | —V., i., 28.

'Of quic'k | cross ligh't | *-(e)nin'g?'* | —IV., vii., 35.

'Wher'e hast | thou sént | the kin'g?' | To Do | *-ver.*' —III., vii., 51.

'Thán the | sea móns | *-ter.* | Pray, sir' | be patiént.' —I., iv., 283.

See also II., i., 94.

'Your sis' | -ter is' | the bét | -ter sold | *-tér.*'—IV., V., 3.

See also V., i., 32; IV., vi., 196; II., iv., 271.

III. We extract the following very convenient table from *The Schoolmaster*:—

OLD DRAWING CERTIFICATES AND THE NEW 'D.'

As several of our correspondents are in doubt as to the counting value of drawing certificates of various ages and classes, we give the following table for reference. *Its preservation will save trouble to our readers, the Science and Art Department, and ourselves*:—

	E. D. Certificate (First Class).	E. D. Certificate (Second Class).
Freehand	(1) *Any* second grade certificate for freehand obtained before the end of 1888, or (2) A first class obtained since 1888	*Any* second grade certificate for freehand.
Model	(1) *Any* second grade certificate for model on paper obtained before the end of 1888, or (2) A first class obtained since 1888, or (3) A pass in model on the blackboard.	*Any* second grade certificate for model on paper or model on the blackboard.
Geometry	Either a pass in second grade geometry or a pass in Section i. of Science Subject i. *plus* any certificate for second grade perspective obtained before the end of 1888 or a first class obtained since 188[illegible]	
Shading from Casts	Any second grade certificate for drawing [illegible] Light and Shade.	

N B—Applicants for certificates may be required to be re-examined in any subject in which they have passed *more than three years previously.*

IV. The appended table of difficult words culled from the Certificate Dictation Exercises has been drawn up for the use of the students in Chester Training College.

FROM CHESTER T.C.

Words for Spelling ... Seniors.

Adequacy	Tintinnabulation (*nn*)	Obligatory
Advocacy	Obeisance	Peremptory
Adscititious	Precincts (*c*)	Sulphurous
Aeronaut	Jeopardy	Surveillance
Alignment	Irrelevant	Tarpaulin
Allotment	Oscillate	Tiara
Alpaca	Scintillate	Truculent
Anachronism	Accede	Valiant
Anteroom	Procedure	Vehement
Antediluvian (*dil*)	Sheriff	Vignette
Apostasy, Ecstasy, Heresy } (*s*)	Pneumatic	Vivacious
	Rehearsal	Witticism
	Cancel	Wont Wonted
Piracy, Aristocracy } (*c*)	Pavilion	Withal
	Vermilion (*one l*)	Withhold (2 *h's*)
Appurtenance (*u*)	Inflammable (*mm*)	Punctilious
Arraign	Appal	Puerile
Artesian	Equinoctial	Paucity
Asbestos	Nauseous	Obstreperous
Asperse	Contestable (*a*)	Nauseous
Asphyxia	Develop	Naiad
Assess	Parasite	Missile
Assign	Vitiated	Miscellany
Auger (*tool*)	Propagation (*a*)	Millenary (*one n*)
Augur	Benefited (*one t*)	Millennium (*two n's*)
Balloon	Solecism	Messuage, Message } *distinguish*
Banister	Proselyte	
Banner -et	Citation	Viscera
Bayon -et	Discern	Viscid
Clarion -et	Wholly	Residuum
Bassoon, Balloon }	Aisles	Rescind
	Impeded	Replete, Reparable }
Belvedere	Marauding	Repertory
Beneficent	Enamel (*one m*)	Reconnaissance
Biliary, Bile }	Vicissitude	Recitative
	Reconciliation	Recipe (*pron.*)
Billowy	Palings	Receipt
Stony	Vengeance	Recipient
Clay -ey	Spectral	Putrid, Putrefy } (*i and e*)
Bitumen	Supersede (*s*)	
Breach (*opening*)	Murrain	Putrefaction
Breech (*behind*)	Loathsome	Prairie (*ai*)
Breech-loading	Enthusiasm	Pommel (*pron.*)
Brigadier	Opaque	Pleurisy (*is*)
Inchneumon	Susceptible	Anointed (*one n*)
Iconoclasm	Fascinate	Supersede (*s*)
Idiosyncrasy	Squalid	Propagation (*a*)
Ignominous	Palliate	Eccentric
Exaggeration	Turbulence	Eclat
Caricature	Mistletoe	Acme
Indictment (*pron.*)	Compulsory	Dishevel
Inaugural	Promissory (*o*)	

V. Mental Arithmetic.

(*Twenty minutes allowed.*)

(1) $532 \times 49 =$

(2) £729 16s. 7½d. ÷ 17 =

(3) Cost of 3 gross of knives at 3¾d. each =

(4) The number of days (inclusive) from September 3rd, 1887 to March 2nd, 1888 =

(5) A rope 132 yards long surrounds an oblong enclosure which is twice as long as it is wide. What fraction of an acre does the rope enclose?

(6) One shilling weighs ⅛ and one penny ⅓ of an ounce. What is the difference in value between a pound of shillings and a pound of pence?

(7) A and B leave Dorking at 9 a.m., B arrives at 4.45 p.m. If A travelled thrice as fast, at what hour did he arrive?

(8) Cost of 3 cwts. of potatoes at ½d. per lb. =

(9) If 14 lbs. cost 3s. 0¾d., what will 18 lbs. cost? =

(10) Value of 19 articles at 11s. 9d. =

(11) Simplify $\frac{3}{7}(\frac{2}{3}+\frac{1}{2}) - 2\frac{1}{17}(\frac{1}{3}-\frac{1}{4}) =$

(12) Express as decimals of £1 to three places only the sums £1 6s. 3d.; 15s. 7½d.; £11 8s. 7d.; 3s. 6½d.

(13) 1·8⅓ of a fortnight in days =

(14) A shopkeeper marks his wares at 60 per cent. above cost price, but allows 2d. in the shilling discount. What is his percentage of profit on cash sales?

N.B.—*To entrap dishonest candidates, similar but not absolutely identical papers are distributed among the Canditates.*

Answers.

(1) 26068.	(8) 14s.
(2) £42 18s. 7½d.	(9) 3s. 11½d.
(3) £6 15s.	(10) £11 3s. 3d.
(4) 182 days.	(11) $\frac{13}{14}$.
(5) $\frac{9}{10}$ acre.	(12) 1·312; ·781; 11·429; ·177
(6) £3 16s.	(13) 25·6 days.
(7) 35 mins. past 11.	(14) 33⅓ per cent.

VI. Algebra.

(*a*) In how many years will a sum of money double itself at 4 per cent. compound interest?

Let x = number of years.

„ y = sum of money.

Then to double itself, it would become $2y$.

At 4 per cent. the amount at end of year = 1·04 of amount at beginning.

The problem therefore is 'How many times will y have to be multiplied by 1·04 before it becomes $2y$?

$$\therefore y \times (1{\cdot}04)^x = 2y.$$

$$(1{\cdot}04)^x = 2.$$

$$\therefore \text{Log. } (1{\cdot}04) \times x = \text{Log. } 2$$

but Log. 1·04 = ·0170333 and Log. 2 = ·3010300

$$\therefore \cdot 0170333 \times x = \cdot 3010300$$

$$\therefore \quad x = \frac{\cdot 3010300}{\cdot 0170333}$$

Ans. = 17·67 + Years.

(*b*) In how many years will a sum of money double itself at 3 per cent. compound interest?

At 3 per cent. the amount at end of year = 1·03 of amount at beginning.

Therefore by the same reasoning as in example (*a*) above

$$y \times (1{\cdot}03)^x = 2y$$

$$\therefore (1{\cdot}03)^x = 2$$

$$\therefore \text{Log.}(1{\cdot}03) \times x = \text{Log. } 2$$

but Log. 1·03 = ·0128372 and Log. 2 = ·3010300

$$\therefore \cdot 0128372 \times x = \cdot 3010300$$

$$\therefore \quad x = \frac{\cdot 3010300}{\cdot 0128372}$$

Ans. = 23·45 + years.

(*c*) In how many years will a sum of money treble itself at 5 per cent. compound interest?

At 5 per cent. the amount at end of each year is 1·05 of amount at beginning.

∴ Equation is—

$$(1{\cdot}05)^x = 3$$

$$\text{Log. } (1{\cdot}05) \times x = \text{Log. } 3$$

but Log. 1·05 = ·0211893 and Log. 3 = ·04771213

$$\therefore \cdot 0211893 \times x = \cdot 04771213$$

$$\therefore \quad x = \frac{\cdot 04771213}{\cdot 0211893}$$

Ans. = 22·51 + years.

(*d*) From the three above examples it will be seen that the general formula for sums of this kind is—

$$x = \frac{\text{Log. } r}{\text{Log. } 1{\cdot}0z}$$

where x = number of years, r = multiple of Principal, and z = rate per cent.

VII. During the last two months we have had numerous applications from would-be Certificate Candidates requesting lists of Text Books, etc., and even the particulars of the Government Syllabus. The language of the letters has been such as to plainly show that two months' work is deemed sufficient to secure a Certificate, We do not envy such so-called students their awakening when 'the List' is published. Besides, it is too late for such to apply for permission to sit, and if they have obtained the 'permit,' our advice is 'Don't use it.'

VIII. Farewell Advice.

(*a*) Don't overstudy during the last fortnight.
(*b*) Revise dates, formulæ, latitude and longitude of the selected maps, and proofs of Mathematical Rules.
(*c*) Take more care now of your mental and bodily vigour, than of acquiring a few more facts.
(*d*) Acting-Teachers should lodge near the Examination Room.
(*e*) Go early to the Examination and come out late.
(*f*) Remember to head each paper, and to give all necessary details.
(*g*) Let the rough work on the scrap side be neat and decipherable.
(*h*) Be symmetrical in answering. Don't favour one question at the expense of another.
(*i*) Be careful to answer the obligatory or recommended questions.
(*j*) Don't write between the lines, or in too small characters.
(*k*) Pay attention to the writing, neatness, composition, and punctuation of the literary answers.
(*l*) Plan out your answer as to style, method, and space before commencing it.
(*m*) Tabulate where possible.
(*n*) Illustrate by diagrams upon the slightest occasion.
(*o*) Find out what the question really means.
(*p*) Don't write round a question, or insert generalities and padding.
(*q*) Make a point of working Euclid Deductions, and demonstrating any proofs.
(*r*) Work with watch before you.
(*s*) Revise every answer and every mathematical step *as soon as finished.*
(*t*) Don't compare answers during examinational intervals.
(*u*) Don't take heavy noonday meals.
(*v*) Avoid exciting beverages.
(*w*) Let every answer show capacity to instruct as well as ability to reproduce.
(*x*) Mind your own business.
(*y*) Eschew the slightest appearance of dishonesty or of connivance thereof.
(*z*) Try to give the Inspector present, and the Examiner hereafter, as little trouble as possible.

IX. The Examination for Certificates will commence on Monday 12th December, 1892, at 3 p.m.

Don't forget to take with you:—

(*a*) The official 'permit.'
(*b*) The certificate of musical proficiency from an Organist, if not already forwarded.
(*c*) The details of your Science and Drawing Successes.
(*d*) Small hand, large hand, and map pens; black and red ink; black, red, and blue pencils, india-rubber, and penknife.

X. *We heartily hope that our Second Year Readers will not require these Articles again.*

SELECTED GOVERNMENT QUESTIONS.

FIRST YEAR.

1. Write in large hand the words '*Pythagorean sages.*'

Write in small hand the words '*He reached the nadir of ignominy.*'

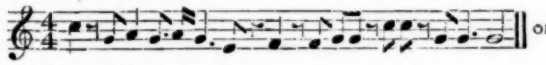
2. Write from dictation:—

'These national questions were canvassed in every company, and the more they were examined the more evidently did it appear to many that liberty was totally subverted, and an unusual and arbitrary authority exercised over the kingdom. Slavish principles, they said, concur with illegal practices; ecclesiastical tyranny gives aid to civil usurpation; iniquitous taxes are supported by arbitrary punishments; and all the privileges of the nation, transmitted through so many ages, secured by so many laws, and purchased by the blood of so many heroes and patriots, now lie prostrate.'—*Hume's History of England.*

3. What are the mental processes concerned in an act of remembering? Distinguish between memory of words and memory of things, of facts, or of truths. Say when, and how far, a teacher is right in requiring the exercise of merely verbal memory.

4. The Code directs that the earliest lessons in History for young children shall be anecdotal and biographical. Give reasons for this recommendation, and mention a few leading incidents in English History which you think might be usefully narrated to learners before their regular chronological study of English History begins.

5. Bar the following passage in accordance with the time signatures:—



Write the time names of—

(1) | 1.1.1 : || (2) | 1 : 1. 1 || (3) | 1. : 1.1,1 ||

State the meanings of the following terms:—

Unison, Accelerando, Largo, Mezzopiano, Syncopation, and ♩. = M 60.

7. Explain the terms—Regular, Irregular, Strong, Weak, as applied to Verbs. Classify the following verbs as Regular or Irregular, and as Strong or Weak:—*fall, fell, fly, flee, flow, hurt, raise, rise, sit, set, sell, spend.*

8. Write a brief essay on:—

(*a*) The uses of the telephone; *or*,
(*b*) 'How small of all that human hearts endure,
That part which laws or kings can cause or cure!'

9. Draw a map of the Darling, or of Africa between the parallels of 10° and 35° South Latitude.

10. (*Men only.*) Arcot, Nellore, Juggernaut, Hyderabad, Allahabad, Agra, Masulipatam, Delhi, Rajpootana, Hurdwar. Give the respective situations of the above, and mention any objects or circumstances of interest connected with any of them.

(*Women only.*) State what are the chief political and international questions in connection with Egypt and South Africa with which British Statesmen have now to deal.

11. What wars have been waged between England and France from 1688 to 1815? What was the immediate cause of quarrel in each case, and by what treaties were they terminated?

12. (*Men only.*) What do you know about The Self-Denying Ordinance, The Solemn League and Covenant, Pride's Purge, The Petition and Advice?

(*Women only.*) In what way was the power of the nobles affected by the Crusades, the Wars of the Roses, and the Reformation?

13. If the hands of a clock coincide every 66 minutes, how much does the clock gain or lose in a day?

Ans. 11 mins. $54\frac{6}{11}$ secs.

14. (*Men only.*) A person sells out £4,000 five per cent. stock at $102\frac{1}{2}$. He lends £1,500 of the proceeds on mortgage at 8 per cent., and invests the remainder in 3 per cent. Consols at $97\frac{1}{2}$. To what extent will his income be affected by these transactions?

Ans. Not at all.

(*Women only.*) The sum of the ages of A and B is 60 years. Ten years ago their ages were as 5 : 3. Find their present ages.

Ans. 35, 25 years.

15. (*Men only.*) If of a bicycle the larger wheel revolves as often in 10 seconds as is its rate in miles per hour, find its diameter.

Ans. 4·6685 ft.

(*Women only.*) Describe the darning of a hole on stocking material by the common method.

16. (*Men only.*) Find the area of the largest circle that can be inscribed in a semi-circle of 10 feet radius.

Ans. $78\frac{4}{7}$ sq. ft.

(*Women only.*) How would you remove inkstains, paint, tar, and grease from clothing?

17. (*Men only.*) Prove the formula $s = \frac{n}{2}\{2a + (n-1)b\}$ where a denotes the first term, b the common difference, n the number of terms, and s the sum of an Arithmetical Progression.

If $s = 72$, $a = 24$, $b = -4$, find n. Ans. 4 or 9.

(*Women only.*) What are silk, cotton, and wool, and what are the chief merits of each material? How ought woollen garments to be washed?

18. (*Men only.*) Prove that $s = \frac{a(1-r^n)}{1-r}$ where s = the sum, r the common ratio, and n the number of terms in a Geometrical Progression.

Sum to n terms $1 + \frac{2}{2} + \frac{3}{2^2} + \frac{4}{2^3}$

Ans. $4 - (n+2)2^{-n+1}$.

(*Women only.*) Distinguish between the duties of a child's maid, a kitchen maid, and an under housemaid.

19. (*Men only.*) Write out Euclid I. 43.

Describe a parallelogram equal and equiangular to a given parallelogram, and having one of its sides equal to a given straight line.

(*Women only.*) Reduce to a decimal accurate to six places—

$$\frac{1}{2\times5} + \frac{1}{2\times5\times8} + \frac{1}{2\times5\times8\times11} \text{ etc.}$$

Ans. ·113722.

20. (*Men only.*) Write out Euclid III. 37.

Describe a circle which shall pass through two given points and touch a given straight line.

SECOND YEAR.

1. As in First Year.

2. As in First Year.

3. (*a*) What constitutes an 'Attendance' in a day school, an infant school, and an evening school respectively? Explain, by help of a specimen extract from a register, the marks used, and the methods of verification.

(*b*) From what registers and in what manner would you ascertain the following particulars:—

(i) The number of times the school has been open;

(ii) The average attendance for the year;

(iii) The number of scholars admitted upon, and the number removed from, the roll during the year?

4. Analyse the faculty called 'Attention'; and show to what extent it is, or is not, dependent on the Will. Specify the sort of lesson or other expedients by which the habit of fixed attention can best be formed and strengthened.

5. As in First Year.

6. As in First Year.

7. Summarise in your own words the attempt of Gloucester at Dover to throw himself from an imaginary cliff.

8. (*Men only.*) Say what you know of William of Deloraine, Watt Tinlinn, The Goblin-Page, Lord Dacre.

(*Women only.*) What historical circumstances gave birth to the words *Dragonnade*, *Refugee*, *Noyade*, *Boycott*, and *Mob*?

9. (*Men only.*) As in First Year.

(*Women only.*) Draw a map of sub-tropical North America.

10. (*Men only.*) As in First Year.

(*Women only.*) Describe the relation of the Federal Government to the several State Governments of the North American Republic.

11. (*Men only.*) As in First Year.

(*Women only.*) What Administrations held office from the death of Pitt until the Accession of George IV.? Trace the history of the National Debt during this period.

12. (*Men only.*) As in First Year.

(*Women only.*) What was the leading principle of Lord Wellesley's Government of India? Mention the chief events in India during his rule.

13. (*Men only.*) Teak is 45 lb. to the cubic foot, while water is $62\frac{1}{2}$ lb., and iron is 7·492 times as heavy as water. What thickness of iron will be the same weight as a 4-inch plank of teak?

Ans. ·384 inches.

(*Women only.*) Find the eighth root of 214358881. Ans. 11.

14. As for First Year (*Men*).

15. (*Men only.*) As in First Year.

(*Women only.*) Cut out in sectional paper and make up a child's pinafore.

16. (*Men only.*) Find the solid content of the regular pyramid on a hexagonal base, each of whose sides is 3 feet, and height 6 feet.

Ans. 46·7658. . . c. feet.

(*Women only.*) Show how the possession of a garden attached to a cottage may be turned to the best account (*a*) in providing for home consumption, (*b*) in selling the produce.

17. (*Men only.*) As in First Year.

(*Women only.*) Describe the methods in which disinfectants should be applied in case of illness, the quantity to be used, and the frequency of application. Name some of those disinfectants which are not costly but yet are powerful.

18. (*Men only.*) Given log. 2 = ·301030, log. 3 = ·4771213, find log. 3·2, log. $14\frac{3}{8}$, log. ·0054, log. ·18.

Ans. ·50515; 1·1583626; $\bar{3}$·7323930; $\bar{1}$·2552726.

(*Women only.*) Name *six* dishes which may be made from a neck of mutton, describing fully the ways of preparing *one* of them. Which is the best way of peeling potatoes?

19. (*Men only.*) As in First Year.

(*Women only.*) If the velocity of sound be 1,100 feet per second, and that of a cannon ball be 1,000 feet per second, calculate the distance from the gun of a spot where the report is heard $\frac{1}{10}$ minute before it is struck by the shot. Ans. 8,250 feet.

20. (*Men only.*) Write out Euclid IV. 16.

What regular figures of less than fifty sides can be inscribed in a circle by Euclid's methods?

CORRESPONDENCE.

We shall be pleased to reply briefly and through these columns to anyone seeking examinational information and advice.

This privilege does not, of course, extend to furnishing the solutions and answers of problems. All such communications should be addressed to 'THE QUERY EDITOR.'

Replies demanding urgency will be promptly forwarded per post on receipt of a stamped and addressed envelope. A post will be saved by writing direct to DR. GEORGE BEACH, M.A. (*Examination Editor of 'Practical Teacher'*), STANLEY MOUNT, MACCLESFIELD.

P. S. (Southport), R. N. (Devizes), P. U. (Woodford), C. P. (Cheltenham), H. N. (Pedmarsh), S. S. (Aberystwyth), N. T. (Edinburgh), G. H. (Stourbridge), N. A. (Silchester): Gill's Theoretical Chemistry, Newsholme's Hygiene, 3s., Low's Applied Mechanics (Blackie), 2s., Buckeridge's Chemical Student's Manual (Murby), 2s. 6d., Certificate Questions (National Society), 6d., 'How to Shade from Models and Casts,' by Sparkes (Cassells), 3s., Cartwright's 'Mental and Moral Science' (Hughes), 2s. 6d., Wrightson's 'Principles of Agricultural Practice' (Chapman and Hall), 5s., Angel's Practical Plane Geometry and Projection, Vols. I. and II.

(Collins), 4s. and 6s., Science Questions (Eyre and Spottiswoode), 6d. per year, Roscoe's 'Lessons in Elementary Chemistry' (Macmillan), 4s. 6d., Draper's 'Sound, Light, and Heat' (Blackie), 2s., Gregory's Physiography (Hughes), 2s. 6d., Goodeve's 'Steam and Gas Engine' (Lockwood), 6s.

H. N. (Bromley).—The Elementary Teacher's Certificate ranks with the 'D.'

O. L. (Halifax).—Hassell's 'Common Things' (Blackie).

'ROYSTON' (——).—You are liable to re-examination.

J. O. (Glasgow).—Not illegal, nor commendable.

J. A. S. (Bradford).—5, Cheapside, in your own town.

S. P. M. (Southampton).—Stanford's School Board Map of London.

U. O. (Tynemouth).—Gregory's 'Advanced Physiography' (Joseph Hughes and Co.).

'DOUBT' (Leominster).—See Article 72.

'MAG' (Redditch).—Apply to the Organising Secretary of County Council.

S. M. A. (Douglas).—Virgil's Æneid, Book I.

S. M. S. (Bilston).—They must pass in all three to secure Honour Certificates.

H. P. (Swansea).—A clergyman can be a teacher in a Night School.

'15 ft.' (Birmingham).—She can delay as long as she please.

T. R. R. (Stourbridge).—(1) You had best write to the Science and Art Department. (2) Its absence is not a disqualification at *present*.

P. T. (Barnsley).—You cannot be examined in Light and Shade during your apprenticeship.

'EX.' (Exeter).—No Grant, as she is not duly qualified.

S. U. (Teignmouth).—Apply at once.

FIRST YEAR (————).—(1) Easily obtained from any scholastic stationer. (2) You may substitute a Language and a Science.

R. W. N. (Truro).—Permission to extend indentures must be obtained.

B. O. (St. Helier).—Requires particulars of examinations in which only French is taken.

T. M. S. (Ewell).—Wishes to know the publishers of 'School and College Songs.'

T. J. (Workington).—Method of 'equal additions.'

S. J. (Boston).—You can obtain marks for your Infant Class.

E. H. (Newcastle).—Either 1st or 2nd class counts.

T. Y. (Barnstaple).—Send the certificate up to Department *at once*.

H. S. (Bury).—We had hoped to have inserted a sketch of Archbishop Trench's career, but lack of space forbids.

J. W. (Reading).—Women candidates cannot take Mathematics.

F. F. (Winchester).—You are qualified as an assistant.

H. W. (Culham).—See this month's issue.

U. M. P. (————).—The meridians converge at the poles, so that in high latitudes the value of a degree of longitude is small; but as it is noon at the same time along the same meridian, the value in time does not alter. Get a globe and study this.

H. T. (Swansea).—The vacancy must not exceed three months.

M. S. (Drighlington).—Sit, if you have permission.

B. B. (Cardiff).—The Bible, Shakespere, Prayer Book, and Bacon's Essays.

T. R. (Bedford).—Wrightson's 'Principles of Agriculture.'

A. J. (Cardigan).—See Certificate syllabus.

S. C. (Calder Hall) —See Model Answer to P. T. Mathematics and the Grammar of our P. T. course.

S. M. (Beccles).—A Trained Teacher must refund his Scholarship money on entering the Civil Service.

H. N. (Old Trafford).—About 80 per cent. Capitals poor.

P. P. S. (Dundee).—The Drawing Marks will be accredited, even if not known at the Examination itself.

A. R. (Aberystwith).—The repetition must be said again. Last year's marks will not count.

'78 (Chester).—Macmillan's. See above.

LETTERS ANSWERED PER POST:—

S. L. L. D. (South Shields), JAN (Yarmouth), T. T. (S. Pierre), M. H. P. (Cardiff), H. L. (Longton), X. (Podmore), A. F. C. (Holborn Bars), J. J. C. (Thetford), T. N. A. S. (Londonderry), G. W. (Newtown), H. E. P. (Lynn), S. O. (Wolverhampton), W. B. W. (Stoke), T. J. (Pontypridd), SON (Axminster), T. U. B. (Stockport), FANNY (Swansea), S. A. H. (Woodley), S. S. L. (Aberdeen), W. M. Q. (Newcastle-on-Tyne), S. T. (Warminster), M. K. (Liverpool), ONCE (Soho), A. D. A. (Northampton), W. W. (Fisherton), A. C. (Carlisle), G. B. (Sheffield), Two letters, S. N. (Baskerfield), B. G. (North Shields), H. C. (Chelford), J. E. L. (Frizington), O. T. (Mansfield), H. E. S. (Malton), J. H. D. (Derry Ormond), J. J. L. (Dawley), T. H. (Llanarthney), USE (Harrogate), F. A. E. (Winsholme), J. R. (Swansea), FRATER (Hastings), H. E. C. (Hill Top), D. L. (Ulverston), H. (Dunoon, Argyleshire), W. C. (Liverpool), K. M. (Worthing), W. P. B. (Chorley), A. B. H. (Thorpe Hamlet), T. B. (Dudley), S. K. T. (Dulwich), H. L. C. (Bardon), Two letters, S. J. M. (Dowlais), A. C. (Great Yarmouth), SLIDE (Burslem), P. T. (Wednesbury), W. B. (Loughborough), A. E. E. (Garth), TEMPERANCE (Bury), R. S. (Charlesworth), MINA (Clanfield), W. W. (Edinburgh), D. G. (Dunscore), T. K. (———), T. C. (Bamburgh), R. C. (Cheadle), R. C. (Devonport), A. W. P. (Hinckley), KHYBOSH (Leamington), R. N. (Ellenboro), H. G. (Goldenhill), B. G. (North Shields), J. D. K. (Rotherham), S. A. P. (Nechells), G. H. B. (Manchester), L. L. K. (Soothill), H. B. (Haslingden), T. N. (Builth), R. U. P. (Belfast), J. T. (Fleet Street), F. J. H. (Rochester), M. B. (Stockport), A. I. (Stockton-on-Tees), T. R. (Leamington), L. G. (Middlewich), A. F. S. (Leeds), A. M. W. (Saltaire), TOWN (Oxford), M. C. (Eastwood), R. U. (Rochdale), W. R. G. (Rainford), T. L. (Gravesend), —— (Greetland), M. L. (Builth), T. H. (Llanarthney), P. R. K. (Belston), M. M. L. (Hulme), A. W. (Bolton), E. J. G. (Saundersfoot), W. C. (Ulverston), C. H. S. (Cardiff), 'TONY' (Gateshead), J. D. (Churchtown), S. L. (Bristol), J. H. R. (Llangurig), M. C. (Manningham), J. H. (Port Talbot), G. G. (Walsall), E. J. G. (Saundersfoot), Two Letters, F. S. (Hulme), H. C. (Macclesfield), B. H. L. (Upton), A. L. (Wareham), R. S. G. (Ayton), H. M. (Edgbaston), G. L. (Hirwain), T. S. (Wandsworth), W. C. (Ulverston), M. L. (High Wycombe), H. S. (Millom), H. H. (Bolton), W. W. (Salisbury), H. E. Y. (Janson Road), H. B. (Haslingden), W. H. W. (York), R. T. H. (Exeter), E. S. M. (Earl's Barton), A. S. (Newcastle-on-Tyne), T. W. G. (Spalding), Two Letters, J. A. (Taibach), JOHN (——-), H. H. H. (Bradford), J. S. (Queensbury), A. C. (Malden), S. J. W. (Stalybridge), E. D. (Elmstone), M. M. L. (Hulme), L. S. J. (Bristol), S. W. (Leeds), M. E. G. (Garth), A. E. (Stockton-on-Tees), G. S. (Bury St. Edmunds), E. A. R. (Attleborough), W. C. B. (Blyth), E. D. (Elmstone), W. J. S. (Newport, Mon.), C. B. (Chelsea), Auchandland (Banffshire), W. H. T. P. (Southsea), E. A. P. (Battle, Brecon), STONE (Stoke), H. U. (Dudley), S. P. P. (Uttoxeter).

Specimen of unsolicited letter of thanks just received.

'DR. BEACH, Dear Sir,—The Scholarship list being published, I find I have obtained the position No. 19* in the First Class, thereby being enabled to enter —— Training College next year as a Resident Student. Working as I did from your routine in the "PRACTICAL TEACHER," I feel that I owe a great portion of my success to your kind (though to you unknown) help.

'I therefore take this opportunity of offering you my heartiest thanks for the same.

'Wishing you every success in your routines during the coming months, I beg to subscribe myself,

'Yours gratefully,

* * *'

——o——

SCHOLARSHIP FRENCH.

BY W. T. THOMPSON, B.A. (LOND.),

Honours at Matriculation, with Marks qualifying for Third Prize, First Class French Honours, with Marks qualifying for the Prize; Second Class German Honours; Co-Director of the Birkbeck Training Classes.

NOTES AND VOCABULARY TO 'LA JEUNE SIBÉRIENNE.'

[*N.B.—The rules referred to will be found in the September part of the* PRACTICAL TEACHER.]

18.16.—*pour que—échapper à personne*, in order that the striking analogy which it presented with the intended journey could escape anyone.

Subj. after *pour que* by Rule F (5). *Pût*, imperf. subj., 3 sing. of *pouvoir*, be able.

18.23.—*celui-ci*, the latter; *celui-là*, the former.

18.24.—*s'éleva*, raised his voice.

18.26.—*croyez*, pres. ind., 2 pl. of *croire*, believe.

18.27.—*s'on*. *On* is written *l'on* after *et*, *que*, *ou*, *si*.

18.27.—*puisse*, pres., subj., 3 sing. of *pouvoir*, be able. Subj. by Rule F (2).

18.28.—*ouvrant*, pres. part. of *ouvrir*, open.

18.32.—*manquera*, fut., 3 sing. of *manquer*, fail.

18.34.—*boire*, inf.; to drink.

18.34.—*quand vous aurez soif*, lit. when you will have thirst, *i.e.*, when you are thirsty. The fut. is used in French when we use the pres. after *lorsque*, *quand*, *aussitôt que* (as soon as); *dès que* (as soon as), when a future state is referred to.

18.36.—*de semblables espérances*, lit. some such hopes. Do not translate 'some.' The partitive article is translated by *de* only when an adj. precedes the noun.

18.39.—*loin*, adv.; far.

18.39.—*apparût*, impf., subj., 3 sing. of *apparaître*, appear.

18.41.—*cependant*, conj.; however.

19.1.—*quand—moi-même*, even if I should oppose it (lit. oppose myself to it), myself. *Quand* when used in this sense is usually accompanied by *même*.

19.2.—*ébranlé*, past part. of *ébranler*, to shake.

19.4.—*s'écoula*, glided away; elapsed.

19 4.—*sans qu'il fût question du départ*, lit. 'without there being any question of departure,' *i.e.*, 'without any allusion being made to her departure.'

19.7.—*réduit*, noun masc., sing., retreat; small apartment.

19.11.—*à craindre sérieusement—son projet*, to seriously fear that she would carry out her intention.

Craindre, *avoir peur*, and other expressions meaning *to fear*, are not only followed by the subjunctive, but require *ne* before it, except when they are used in an interrogative on negative sense.

19.13.—*prenaient*, impf., 3 pl. of *prendre*, to take.

19.15.—*à l'ordinaire*, usual.

19.16.—*la* the pronoun *her*. See note on 5.9.

19.16.—*crurent*, pret., 3 pl. of *croire*, believe.

19.16.—*partie*, past part., fem., sing. (because referring to *la*) of *partir*; set off.

19.19.—*paysannes*, noun, fem., pl. of *paysanne*, peasant girl. Our word *peasant* is from *paysan*.

19.19.—*chaumière*, noun, fem., sing.; hut.

19.20.—*voisine*, adj., fem., sing.; neighbouring.

19.20.—*s'y était arrêtée*, lit. had stopped herself there, *i.e.*, had stayed there. *Y*, and not *là*, is used for *there*, because the place referred to (*chaumière*) has only just been mentioned.

19.21.—*revint*, pret., 3 sing. of *revenir*, return.

19.23.—*tardé*, past part. of *tarder*, to be slow.

19.24.—*cru*, past part. of *croire*, to believe. The past part. of *croître*, to grow, is spelt in the same way, but has a circumflex accent (*crû*).

19.24.—*quittés*, past part., masc., sing. of *quitter*, leave; masc., plur., because dir. obj. (*nous*) precedes it. Rule D.

19.26.—*puisque*, conj.; since. The *preposition* 'since' is *depuis*.

19.28.—*de m'avoir privée*, lit. 'to have deprived me,' *i.e.*, 'that you have deprived me.' Past part. is fem., sing. by Rule D.

19.31.—*sans répondre*, without answering. The French gerund has the same form as the infinitive.

19.32.—*d'un ton*, in a tone.

19.33.—*en*, by it. *En* is the pronoun. See note on 6.9.

19.34.—*promit*, pret., 3, sing. of *promettre*, to promise.

19.34.—*de ne plus mettre d'opposition*, no longer to put any opposition.

19.36.—*dépendrait*, condit., 3 sing. of *dépendre*, depend.

19.39.—*que n'auraient pu—les plus vives*, than the most lively supplications would have been able to do. Do not translate the *le* before *faire*, nor the *ne* before *auraient*. When a sentence follows a comparative (*plus éloquemment*), *ne* is introduced before the verb, except the comparative is used negatively or interrogatively.

19.42.—*à quoi se résondre*, lit. 'to what to resolve himself,' *i.e.*, what resolution to take.

20.2.—*pommes de terre*, potatoes; lit. 'earth-apples.'

20.3.—*près de*, near.

20.4.—*immobile*, adj., motionless; *plein*, adj., full.

20.5.—*ne faire aucune attention*, to pay no attention. Notice that our idiomatic verb '*pay*,' used with 'attention,' is translated into French by 'faire.'

20.6.—*revenant*, pres. part. of *revenir*, return.

20.7.—*tout à coup*, suddenly.

20.9.—*achevant*, pres. part. of *achever*, take.

20.12.—*s'aider*, help one another. *Se* very often has this reflexive sense.

20.14.—*viens*, pres. ind., 1 sing. of *venir*, come.

20.21.—*de lui inspirer*, to inspire to him, *or* 'in him.'

20.22.—*survint*, pret., 3 sing. of *survenir*, come up.

20.23.—*fléchir*, vb. inf.; to bend.

20.24.—*put*, pret., 3 sing. of *pouvoir*, be able.

20.24.—*s'y résoudre*, lit. 'to resolve herself to it,' *i.e.*, 'to make up her mind to it.' See note on 19.42.

20.30.—*d'ailleurs*, moreover. *Ailleurs* is the adv., *elsewhere*.

20.30.—*craignait*, impf., 3 sing. of *craindre*, fear.

20.32.—*Que faire?* lit. 'what to do?' *i.e.*, 'what shall I do?' The infinitive is often used in this way in questions which denote perplexity.

20.33.—*faudra*, fut., 3 sing. of *falloir*, be necessary.

20.34.—*s'élança au cou*, lit. 'leaped to the neck,' *i.e.* 'fell on the neck.'

20.35.—*Soyez*, imperat., 2 pl. of *être*, to be.

20.35.—*sûr*, adj., masc., sing., 'sure.' Do not confound it with *sur* (no accent), 'upon.'

20.36.—*accablant*, pres. part. of *accabler*, to overwhelm.

20.37.—*vous ne vous repentirez point*, you will not repent.

20.38.—*de m'avoir écoutée*, that you have listened to me. See note on 19.28.

20.38.—*irai*, fut., 1 sing. of *aller*, go.

20.40.—*jetterai*, fut., 1 sing. of *jeter*, throw.

20.41.—*qui m'en inspira la pensée*, lit. 'who inspired to me the thought of it,' *i.e.* 'who inspired me with the thought of it.'

21.1.—*voudra*, fut., 3 sing. of *vouloir*, to wish. *Vouloir*, to wish; *vouloir bien*, to be willing.

21.1.—*celui*, pron., masc., sing.; *that*.

21.4.—*crois tu que l'on puisse*, Do you believe that one can? Subj. by Rule F (2).

21.7.—*de toutes parts*, on all sides. *Une partie*, a part (of a whole); *Un parti*, a political party; *une part*, a share.

21.9.—*pourras*, fut., 2 sing. of *pouvoir*, be able.

21.10—*seuil*, noun masc., sing., threshold; *en passer le seuil*, to pass the threshold of it.

21.10.—*mendiante*, adj., fem., sing., a beggar. Our word, *mendicant*.

21.11.—*habits*, noun, masc., pl., clothes.

21.12.—*oseras*, fut., 2 sing. of *oser*, dare.

21.15.—*en*, by them.

21.16.—*l'emportait*, lit. 'carried it off,' *i.e.*, 'gained the day.'

21.17.—*Conçois*, pres., ind., 1 sing. of *concevoir*, to conceive.

21.18.—*que vous inspire—pour moi*, which your tenderness for me inspires you with. When a sentence commences with the relative *que*, the subject (*tendresse*) especially if, as here, accompanied by an enlargement (*pour moi*), is placed after the predicate.

21.19.—*que de motifs?* how many motives?

21.21.—*de combien*, with how many.

21.22.—*inespérées*, adj., fem., pl. (agreeing with *faveurs*); unlooked for.

21.22.—*comblée*, past part., fem., sing. of *combler*, to heap upon. Rule D.

21.23.—*mis*, past part. of *mettre*, to put.

21.26.—*c'est lui*, it is he. After *c'est*, *ce sont*, 'it is,' the *disjunctive* pronouns (*moi*, *toi*, *lui*, etc.) are used, and not the *conjunctive* pronouns (*je*, *tu*, *il*).

21.29.—*malgré*, prep., notwithstanding.

21.33.—*qui m'a fait surmonter*, who has caused me to surmount. Notice that the past part. of *faire*, when used with another verb does *not* by Rule D agree with the preceding direct object (*me* = *Prascovie*).

21.35.—*protégée*, past part., fem., sing. of *protéger*, protect. Fem., sing. by Rule D.

21.35.—*jusqu'ici*, up to the present.

21.35.—*saura*, fut., 3 sing. of *savoir*, to know. Here used in the sense of *to be able*.

21.38.—*doivent*, pres. indic., 3 pl. of *devoir*, to owe. Here translate 'must.'

21.41.—*Dès*, prep., from (referring to time); do not confound it with *des*, of the; *dés*, noun, pl., thimbles.

22.1.—*On n'en détermine point encore l'époque précise*, lit. 'one did not yet fix the precise date of it.'

22.3.—*Secours*, noun, masc., pl.; help.

22.4.—*Plusieurs*, adj., several. The *pronoun* 'several,' as in the next line, is *quelques—uns*.

22.8.—*permis*, past part., masc., sing., *permettre*, permit.

22.9.—*il se proposait d'en profiter*, lit. 'he proposed to himself to profit by them'; *i.e.*, 'he proposed to avail himself of them.'

22.11.—*qui pût*, who might. The subj. is used because the sentence with *qui* does not express a fact about *voyageur*, but tells the kind of *voyageur*.

22.12.—*marches*, noun, fem., pl.; stages (of a journey).

22.12.—*trompé*, past part., masc., sing. of *tromper*, to deceive.

22.13.—*attente*, noun, fem., sing.; expectation.

22.16.—*un rouble en argent*, a silver rouble. Notice that 'a silver rouble' is not '*un rouble d'argent*,' but '*un rouble en argent*.' *En* is used to show the *material* of which anything is made.

22.17.—*tenté*, past part., masc., sing. of *tenter*, try.

22.18.—*modique*, adj., masc. and fem.; modest.

22.19.—*d'après*, according to.

22.21.—*Aussitôt que—dans le village*, as soon as the news of it spread in the village.

22.23.—*vinrent*, pret., 3 pl. of *venir*, come.

22.24.—*poussées*, past part., fem., pl. (to agree with *connaissances*), of *pousser*.

22.24.—*plûtot*, rather. *Plus tôt*, sooner.

22.28.—*de lui avoir accordé*, for having granted to him.

22.33.—*de se rendre service*, to render service to one another. See note on 20.12.

22.33.—*au besoin*, in case of need.

22.35.—*en*, from them.

22.35.—*ils ne lui laissèrent—présages*, in parting from her (*en la quittant*), they left her only sinister forebodings.

22.38.—*prirent*, pret., 3 pl. of *prendre*, take.

22.42.—*Sans parvenir—au souverain*, without herself reaching as far as the sovereign.

22.45.—*lorsqu' on la connaîtra*, lit. 'when one will know her,' *i.e.*, 'when they know her.' See note on 18.34.

22.45.—*qu' on l'aimera. Que* here = *lorsque*. Instead of repeating a conjunction introducing a subordinate sentence (like *lorsque*), *que* only is used.

22.47.—*aube*, noun, fem., sing.; dawn.

23.1.—*revinrent*, pret., 3 pl. of *revenir*, return.

23.1.—*congé*, noun, masc., sing.; leave.

23.2.—*assister*, when, intrans., as here, = to be present.

23.3.—*toute disposée*, quite prepared. The adv. *tout*, 'quite,' takes the form of the feminine when preceding a feminine adj. commencing with an aspirated *h* or a vowel.

23.4.—*chargée*, past part., fem., sing. of *charger*, to load.

23.6.—*remit*, pret., 3 sing. of *remettre*, hand over.

23.6.—*lui destinait*, intended for her.

23.10.—*jusqu' à*, as far as.

23.11.—*leur*, the pronoun 'to them,' because a verb (*devenir*) immediately follows.

23.12.—*la lui faire accepter*, make her accept it.

23.14.—*voulurent*, pret., 3 pl. of *vouloir*, wish.

23.14.—*fonds*, noun, masc., sing.; capital.

23.15.—*emportait*, imperf., 3 sing. of *emporter*, take away.

23.16.—*offrit*, pret., 3 sing. of *offrir*, offer.

23.23.—*vous en aurez une part*, you will have a share in it. See note on 21.7.

23.24.—*rayons* noun, masc., pl., rays.

23.25.—*levant*, pres. part. of *lever*, to rise.

23.25.—*parurent*, pret., 3 pl. of *paraître*, appear.

23.26.—*venue*, past part., fem., sing. of *venir*, come; fem., sing., by Rule C.

23.27.—*s'assit*, pret., 3 sing. of *s'asseoir*, sit down.

23.27.—*ainsi que*, as well as.

23.29.—*d'usage*, customary.

23.29.—*pareille*, adj., fem., sing. of *pareil*, like, s'milar.

23.30.—*part*, pres., indic., 3 sing. of *partir*, set out.

23.31.—*de long cours*, of long duration; or simply 'long.'

23.32.—*adieux*, noun, masc., pl.; farewells. *Adieu* is really *à Dieu*, 'to God,' *i.e.*, 'I recommend you to God's keeping.'

23.33.—*s'assied*, pres., ind., 3 sing. of *s'asseoir*, sit down.

23.34.—*doivent*. See note on 21.38.

23.35.—*laquelle*, which. 'Which,' after a preposition, or followed by 'of,' is translated by *lequel, laquelle*.

23.36.—*on se lève*, they get up.

23.39.—*coup d'œil*, glance.

23.40.—*paraît*, pres., 3 sing. of *paraître*, appear.

23.40.—*insignifiante*, adj., fem., sing.; meaningless.

23.40.—*quelque chose d'intéressant*, something interesting. *Rien, quelque chose* when accompanied by adjectives, require that these adjectives shall be connected with them by *de*.

23.41.—*avant de*, before (when preceding a gerund, as it does here).

23.44.—*ensemble*, adv.; together.

With the next issue of the PRACTICAL TEACHER we shall commence a series of Examination Papers on the author, modelled on the papers set at the July Examination. Students must study carefully the notes on the conjugation of the regular and irregular verbs, given at the end of the paper on 'Le Directoire' in this part. They are intended for the use of both Scholarship and Certificate students.

—o—

'LE DIRECTOIRE' OF MME. DE STAËL.

BY W. T. THOMPSON, B.A. (LOND.),

First Class French Honours; Co-Director of the Birkbeck Training Classes.

N.B.—The Roman numerals preceding the passages cited are the chapters; the two figures following are respectively the page and line in Victor Oger's edition of 'Le Directoire' (Hachette and Co.), in which the passage is found.

The rules referred to will be found in the paper on 'Scholarship French' in the September number of the PRACTICAL TEACHER.

X. 40.1.—*non qu'il voulût*, not that he wished. The conjunction *non que* governs the subjunctive. (Rule F. 5.)

Further example:—

XII. 53.36.—*non qu'il prétendît*, not that he pretended.

X. 40.9.—*C'est un des grands défauts des Français—que de s'imiter les uns les autres*. The *que* here is expletive. Translate 'It is one of the great defects of the French to imitate one another.' Mme. de Staël frequently uses this expletive *que*.

Further examples:—

XI. 48.29.—*c'est une injustice que d'en exclure*, it is an injustice to exclude from it.

XIII. 54.23.—*c'était n'avoir aucune idée—que d'imaginer—naître*. 'To imagine that in counterfeiting it would be produced was to have no idea of the nature of enthusiasm.'

XIII. 55.15.—*c'était en effect—que la facilité*, etc. 'The ease was, in fact, a singular thing.'

XVIII. 80.24.—*C'était déjà beaucoup trop que d'avoir défendu*, etc. 'To have defended, etc., was already far too much.'

X. 40.25.—*au plus grand attentat—principes*. 'To the greatest crime which, according to its own principles, it could commit.' Subj. (pût) by Rule F. (6).

X. 40.27.—*A dater de cet acte*, dating from this act.

X. 40.28.—*il n'a plus existé—aucun respect*. There has no longer existed—any respect. The frequency of this impersonal use of *il* in Mme. de Staël has been pointed out under I. 2.17 (November part). Further examples:—

X. 41.7.—*Il régnait un ton*, there reigned a tone.

XII. 50.4.—*Il ne se passait presque pas un seul jour qu'il n'allât se promener*, there hardly passed a single day when he did not take a walk.

XII. 53.40.—*afin qu'il ne pût exister le moindre doute sur sa parfaite impartialité*, in order that there could not exist the least doubt on his perfect impartiality.

XIV. 59.11.—*il est un genre d'exaltation désintéressée*, there is a kind of disinterested greatness (of mind).

X. 41.10.—*en magistrat*, as a magistrate.

Further examples:—

X. 43.27.—*en homme*, as a man.

XVII. 72.12.—*en athlète*, as an athlete.

X. 41.15.—*On se plaisait à lui croire toutes les facultés généreuses.* People took pleasure in believing that he had (lit. in believing to him) all the generous faculties.

Further examples of this peculiar use of the dative pronoun (me, te, lui, etc.), with verbs of thinking and feeling :—

XI. 49.6 —*qu'il me supposait*, which he supposed I had (lit. which he supposed to me).

XIII. 56.20.—*il ne se sentait peut être pas assez d'habileté politique.* Perhaps he did not feel that he had (lit. he did did not feel to himself) enough political ability.

XV. 63.34.—*je me sentais—respirer.* I felt (lit. I felt to myself) in that instant a difficulty of breathing.

X. 41.20.—*ne savait où se prendre*, did not know where to find an object.

X. 41.24.—*Je ne trouvai pas de paroles.* I did not find words (lit. any words.)

De after a negative = any.

X. 41.29.—*lui succéda*, followed it (lit. to it), *i.e.*, the trouble caused by admiration. See note on I. 1.6.

X. 41.35.—*Il n'y avait rien—qui pût me rappeler.* There was nothing—which could recall to me. Where the sentence containing the relative *does not state a fact*, but is used *to express the quality* of a noun in the principal sentence, the subjunctive is used. The sentence with *qui* can in these instances often be translated by a qualitative infinitive—'there was nothing—to recall to me.'

Further examples :—

XI. 46.27.—*il n'y aurait pas quatre qui s'y opposassent*, there would not be four (persons) to oppose it.

XIII.—*une harmonie naturelle qui garantisse leur durée*, a natural harmony capable of guaranteeing their duration.

X. 42.2.—*à la façon des individus à nous connus*, in the style of individuals known to us.

X. 42.10.—*il m'intimidait toujours davantage*, he intimidated me always more. *Davantage* is used to translate 'more' at the end of a sentence.

X. 42.17.—*c'est un habile joueur—et mat.* He is a skilful chess-player, of whom the human race is the opponent (*la partie adverse*) whom he proposes to himself to check and to checkmate.

He is, she is, when a noun or a pronoun follow the verb, are translated by *c'est*.

X. 42.19.—*Ses succès tiennent—qu'il possède.* His successes are as much due to the qualities which he lacks as to the talents which he possesses.

X. 42.21.—*Ni la pitié—ne sauraient.* Neither pity, etc., could. Further examples of the use of the conditional of *savoir* (know) in the sense of *could*.

XI. 49.23.— *C'est un homme qui ne saurait être naturel que dans le commandement.* He is a man who could only be natural in command.

X. 42.33.—*d'une façon*, in a fashion. 'In' with nouns implying *fashion* or *manner* is *de*.

Further examples :—

XIII. 56.37.—*de quelle manière il les a conduites*, in what manner he has conducted them.

XV. 65.5.—*d'une façon généreuse*, in a generous fashion.

XVII. 76.13.—*d'une manière décente*, in a decent manner.

XVIII. 79.31.—*de quelle façon servile*, in what servile fashion.

X. 42.39.—*à laquelle rien de grand ni de beau—ne pouvait échapper*, from which nothing great or beautiful could escape.

The adjectives qualifying 'nothing,' 'something,' etc., are connected in French by *de* with the substantive, as quelque chose *de* bon—*something good.*

Further examples :—

XI. 46.24—*Je ne pense à rien de semblable*, I think of nothing similar (or *nothing of the sort*).

XI. 47.25.—*ce que Bonaparte fit surtout de condamnable.* The thing especially worthy of condemnation which Bonaparte did.

XIV. 57.24.—*ce qu'il y a d'involontaire dans la nature des hommes*, what is involuntary in the nature of men.

X. 43.22.—*c'est le seul homme qui ait jamais réuni la plus parfaite précision.* He is the only man who has ever united the most perfect precision. For the subj. see Rule F (6).

X. 43.28.—*dont il ne peut tirer parti*, from whom he can get no advantage.

Tirer parti de, get advantage from (someone *or* something).

X. 43.30.— *ce qui lui va très-mal*, which suits him very badly, *i.e.* which spoils his figure. Further example of *aller* in this sense.

X. 43.39.—*le dédain lui va mieux*, scorn suits him better.

The verb *seoir* (to suit, to become) is used in the same sense.

X. 43.36—*c'est la guerre qui lui sied*, it is war which suits him.

X. 43.39.—*Aussi ne s'en fait-il pas faute.* For *aussi* in the sense of *therefore* see note on II. 8.32. '*Therefore* he does not abstain from it' (*i.e.*, *dédain*, scorn *or* contempt).

Se faire faute de (something) = to abstain from doing it.

Further examples of *aussi* (= therefore).

XII. 52.36.—*aussi s'est-elle enfin montrée*, therefore it finally showed itself.

XVI. 67.18.—*aussi Bonaparte paralysait-il toute espèce de résistance*, therefore Bonaparte paralysed all kinds of resistance.

XVI. 70.16.—*aussi l'important pour Bonaparte était-il.* The important thing for Bonaparte was therefore—

X. 44.8.—*qui vent bien se laisser questionner*, who is willing to allow himself to be questioned.

Vouloir = to wish. *Vouloir bien* = to be willing.

X. 44.15.—*on eût dit qu'à l'inverse du prophète.* You would have said that, to reverse the story of the prophet.

For *eût* in this sense see note on VIII. 31.40.

Further example of this use of *eût*.

X. 45.20.—*La terre n'eût pas mieux demandé.* The earth would have asked nothing better.

X. 44.24.—*il est naturel—pourquoi.* It is natural that they should wish to know why. *Avoir envie* = to wish. *Get up carefully the meanings of the phrases with avoir* (*avoir raison ; avoir sommeil ; avoir chaud*, etc., etc.)

For subj. *aient* see Rule F (1).

X. 44.27.—*doivent en être autant accusés*, lit. 'Ought to be as much accused of it,' *i.e.* 'are as much in fault.'

X. 44.39.—*avant que — eût subi*, before the national representation had suffered. For subj. see Rule F (5).

Avant is a prep. = before. To form the corresponding conjunction add *que* to the preposition.

X. 45.12.—*Combien—vivre*, how many of them has his insatiable ambition allowed to live.

X. 45.28.—*venait de conclure*, had just concluded. See note on I. 4.28. In the same manner.

X. 45.35.—*venait de dire* = had just said.

XIII. 54.4.—*Comme on vient de le voir*, as one has just seen. Do not translate *le* in this case.

X. 45.29.—*Lorsque le bonheur des Français sera—assis*, when the happiness of the French nation is (lit. will be) placed.

The English present tense after *quand; lorsque; aussitôt que, dès que* (as soon as) is translated into French by the future when futurity is implied.

X. 45.33.—*Quoi qu'il en soit*, whatever be the case.

Further example :—

XIV. 58.22.—*Quoi qu'il en soit de ses regrets*, whatever be the case with his regrets.

X. 46.13.—*que sont ils devenus ?* What has become of them ?

X. 46.15.—*qu'en a-t-il fait ?* What has he done with them ?

XI. 47.4.—*à s'emparer de l'imagination*, to take possession of the imagination. Further example of *s'emparer de* (gain possession of).

XI. 47.27.—*afin de s'emparer du trésor*, in order to gain possession of the treasure.

XII. 52.28.—*bien que—la Suisse*, although the Directory wished to gain possession of Switzerland. For subj. see Rule F (5).

XI. 47.30.—*Il n'est pas douteux que le pays de Vaud n'eût le droit—et qu'il ne fasse très-bien.* It is not doubtful that the canton of Vaud had the right—and that it does quite right.

After a verb expressing *doubt*, and used negatively, the subj. preceded by *ne* is required. Do not translate this *ne* into English.

XI. 47.36.—*il ne s'agissait pas—seul.* The canton of Vaud was

not alone concerned. See note on VIII. 34.33. Further examples of *s'agir de* :—

XVII. 76.22.—*il ne s'agissait pas—une nation qui a besoin de faire des phrases*, commanding silence to a nation which feels the need of making epigrams was not the matter in concern.

XVIII. 82.24.—*Il s'agissait d'hommes odieux*, hateful men were concerned.

XI. 48.2.—*Les erreurs que j'ai commises*, the errors which I have committed. For the fem. plu. participle agreeing with *que* (= *erreurs*), see Rule D. Further examples of this rule :—

XII. 55.—*qui les avaient faites* (*les* = the fem. pl. word *lois*).

XV. 60.1.—*les lettres—écrites*, the letters which Bonaparte's brothers had written to him.

XI. 48.27.—*font tenir à l'avantage*, make people value the advantage.

XI. 48.36.—*de s'en servir*, to use it.

XI. 48.39.—*il faut—politiques*, political rights are necessary to men.

XI. 49.9.—*l'agrément—l'air bonhomme*, the charm which people can find in him when he takes a good-natured tone.

XI. 49.17.—*suivant—attacher*, according as he believed that he would attach them to himself.

XII. 50.3.—*au sien propre*, to his own.

XII. 50.12.—*mon père et moi—nous nous plaçames*, my father and I placed ourselves.

When the subject is compounded of a noun or pronoun, or of two pronouns of different persons, the disjunctive form of the pronoun (*moi, toi, lui, etc.*) is used, and the subject is repeated by a plural pronoun of the superior person.

XII. 51.8.—*la médiation même*, the very mediation. See note on III. 12.37. Further examples :—

XII. 53.19.—*les biens mêmes*, the very property.

XV. 64.36.—*à l'instant même*, at the very instant.

XII. 51.20.—*mon propre pays*, my own country.

XII. 51.33.—*Qui ne serait touché ?* Who would not be touched ? When an affirmation, as here, is put into the form of a negative question for the sake of literary effect, *ne* only without *pas* is required for the negative.

XII. 52.6.—*le temps seul—tout-puissant*, time alone is its most powerful ally.

XII. 52.21.—*Sur une portion quelconque*, on some portion or other. See note on I. 3.18.

Further examples :—

XVII. 75.26.—*sous un prétexte quelconque*, under some pretext or other.

XVII. 75.32.—*d'un décret quelconque*, of some decree or other.

XII. 52.22.—*quelque prononcés qu'ils fussent*, however pronounced they were. See note on II. 8.14.

XII. 52.27.—*cela se conçoit*, that can be understood.

XII. 52.37.—*y préluda*, prepared for it. Further example of this use of *préluder* :—

XVI. 69.20.—*Ces féroces jacobins—comtes*, these ferocious Jacobins prepared for the parts of barons and of counts.

XII. 53.22.—*lui qui l'avait toujours été*, he who had always been so. The conjunctive pronoun *il* cannot be used as the antecedent of the relative.

XIII. 54.11.—*Les persécutions—aux prêtres*, the persecutions which they made the nobles and priests suffer.

When, as here, a verb has two objects, one a noun or pronoun (*priests*), and the other an infinitive mood (*suffer which*), the noun or pronoun is put in the dative case (*aux prêtres*).

XIII. 54.22.—*il n'y avait—les statues*, the only Republicans in the Rome of our days were the statues.

XIII. 54.30.—*ne créait—sans cesse*, created only Governments set in motion by springs (*à ressort*), which it was necessary to wind up unceasingly.

XIII. 55.5.—*sans que—part*, without the nation taking the least share in it. See note on I. 1.11.

XIII. 55.18.—*que sais-je ?* literally, 'What do I know ? (*of them ?* understood), *i.e.* how can I be expected to remember such obscure individuals ?'

XIII. 55.20—*le jour d'après*, the day after.

So also :—

XV. 63.29.—*l'instant d'après*, the instant after.

XIII. 55.29.—*qui avaient eu—faire*, literally 'Who had reproaches to make to themselves,' *i.e.*, 'who had to reproach themselves with something.'

XIII. 55.32.—*Prononciez-vous—souvenir*. If you pronounced a word which could have any connection with the recollection. For this conditional meaning of the imperfect when used interrogatively, compare note on V. 19.37. Further example :—

XIII. 55.36.—*Reveniez-vous*, if you returned.

XIII. 55.39.—*soit pour le justifier—pouvoir*. Either to justify it or to cause it to be forgotten by means of (the) power (which he sways) *soit—soit* = either—or.

XIII. 56.1.—*en était arrivée*, had arrived. Do not translate *en*.

XIII. 56.7.—*qu'a dit depuis Bonaparte*, which Bonaparte said since. See note on II. 8.5.

So also :—

XIV. 58.32.—*que tenait la Révolution*, which the Revolution held.

XV. 60.30.—*la peur que causaient les jacobins*, the fear which the Jacobins caused. Further example in XV. 61.28.

XIII. 56.8.—*par terre*, on the ground.

XIII. 56.16.—*se fit tuer*, literally, caused himself to be killed.

XIII. 56.34.—*de quelque genre qu'ils pussent être*, of whatever kind they might be.

See note on II. 8.14.

XIV. 57.21.—*importe à la pensée*, is important to thought.

XIV. 58.1.—*tout en se conduisant*, at the same time as they behaved themselves.

XIV. 58.3.—*ils ne le sont pas*, literally, 'they are not it,' where 'it' refers to the idea of being duped. Do not translate 'le' into English.

XIV. 58.5.—*il n'y a de vrai Dieu que Dieu*, God is the only true God.

XIV. 58.12.—*n'empêcha pas—n'arrêtat*, did not prevent Sir Sidney Smith arresting.

XIV. 59.6.—*apres s'être enfermé*, after shutting himself up. *Après* followed by the gerund (*same form as for infinitive in French*) demands that this gerund shall be in its compound form (*avoir* or *être* with the past participle).

XIV. 59.26.—*il se l'est permise*, literally, 'he has permitted it to himself.' The past participle is in the feminine singular, because the direct object *la* (= *cruauté*) precedes it. See Rule D.

XV. 60.26.— *La tyrannie—mêmes*. Tyranny annihilates even the very military forces.

XV. 60.33.—*C'en était assez*, it was enough.

XV. 61.20.—*on lui faisait craindre—démission*, some one made him fear that General Bonaparte might tender his resignation.

See note on V. 17.16.

XV. 62.9.—*il leur avait donné—à tous*, he had given hope to all of them.

XV. 62.20.—*lui qui*, he who. See note on XII. 53.22. So also two lines lower.

XV. 63.4.—*en se mêlant—intérieures*, in once taking part in interior revolutions. See note on II. 7.18. Further example :—

XVI. 68.11.—*en les menaçant—affaires*, by threatening to no longer interest himself in their affairs.

XV. 63.28.—*allaient l'emporter*, were going to gain the victory. See note on I. 5.1. Further example :—

XVI. 69.36.—*La supériorité—s'emporter*, the superiority of the intellect of Sieyès could not gain the victory.

XV. 63.38.—*dont s'est accomplie—18 brumaire*, in which the revolution of the 18th of Brumaire was accomplished.

XV. 64.8.—*comme il n'a d'enthousiasme—sujet*, as on no subject he has genuine enthusiasm.

XV. 64.27.—*s'approacha de ce général*, approached this general.

XV. 65.17.—*en se refusant—à mettre cette proposition aux voix*, in refusing to put this proposition to the vote.

XV. 65.19.—*S'il y avait Consenti*, if he had consented to it. *Il y avait* is *not* here a tense of *il y a*, 'there is.'

XV. 66.4.—*quel qu'il fût*, whatever it was. See note on II. 8.14.

XV. 66.35.—*n'en seraient pas—à louer*, would not on that account be any the more praiseworthy (lit. *to praise*).

XV. 66.37.—*ne peut rien faire de pis*, can do nothing worse. See note on X. 42.39. The word accompanying *rien* here is, how-

ever, an adverb (*pis*), and not an adjective. This is also the case with *mieux* and *moins*; *rien de mieux*, nothing better; *rien de moins*, nothing less. The reason for this is that in Latin, from which the French language is derived, the comparative adverb had the same form as the neuter comparative adjective. The three words above quoted have retained their adjectival force only when used with *rien* and *quelque chose*.

XVI. 67.8.—*le sortilège—pouvoir*, the most powerful spell that Bonaparte used to found his power. For subj. see Rule F (6).

XVI. 67.13.—*On se donne—batters*, people willingly pretend to fear beaten parties.

XVI. 67.30.—*quelques-uns—fenêtre*, some of those members who had the day before leaped out of the window.

Quelque is an adjective. *Quelqu'un* is a pronoun.

XVI. 68.32.—*dont il se jouait à son gré*, with which he could fight with ease.

XVI. 68.40.—*le hasard peut faire—une chose detaillée*, chance can manage it so that he shall tell you, on any subject whatever, a very detailed story.

XVI. 69.7.—*son ignorance*, ones ignorance.

XVI. 69.7.—*il n'y a que les personnes—des peuples*, it is only persons enlightened by earnest and continued study who can have true ideas on the government of nations.

XVI. 69.25.—*pourquoi nommer*, why should I give names? See note on IX. 38.29.

XVI. 69.28.—*nous en sommes arrivés*, we have arrived. Do not translate *en*.

XVI. 69.32.—*toute rédigée*, fully drawn up.

Tout, as an adverb, takes the form of the feminine when accompanying a feminine adjective commencing with a consonant or aspirated *h*.

XVI. 70.1.—*faute de pouvoir trouver*, because he could not find.

XVI. 70.7.—*sur lesquelles*, out of which. This is one of the meanings of the prepositon *sur*, *e.g.*, *un homme sur douze*, one man out of twelve.

XVI. 70.30.—*les appointements*, the salary.

XVI. 70.35.—*de n'avoir affaire qu'à des hommes payés*, that he had only to do with paid men.

XVI. 70.40.—*canonicats à vie*, appointments (lit., *canonries*) for life.

XVI. 71.12.—*quoi que ce fut*, anything whatever.

XVII. 71.26.—*On ne saurait—la tyrannie*, one could not observe too closely the signs of tyranny.

XVII. 72.1.—*pour faire face—elle-même*, to present a front in turn to each portion of the majority which is ignorant of itself.

XVII. 72.11.—*qu'il n'est arrêté*, as he is stayed. See note on III. 12.39. *Comme* is the conjunction which is repeated by *que*.

XVII. 72.22.—*ne l'ont—secondé*, have only too well aided him.

XVII. 72.23.—*c'est à son funeste génie—s'en prendre*, we must put the blame on his baleful genius. See note on I. 2.40.

XVII. 72.25.—*ayant empêché—n'ent*, having always hindered this nation from having. See note on V. 17.16.

XVII. 73.1.—*il mettait en avant*, he urged as a pretext.

XVII. 73.2.—*tantôt — tantôt = now — now, at one time — at another time.*

XVII. 73.6.—*plus on vent — mécontents*, the more one wishes to coerce by illegal measures, the more dissatisfied persons one makes.

XVII. 73.18.—*d'une grande instruction*, of great learning. See Note on V. 18.9.

XVII. 73.37.—*Chevaliers de la circonstance*, lit. 'knights of circumstances,' in more modern phraseology, 'opportunists.'

XVII. 74.6.—*il pardonnait — désintéressée*, he more willingly pardoned a selfish calculation than a disinterested opinion.

Pardonner quelque chose
Pardonner à quelqu 'un.

XVII. 74.13.—*laisser faire les murs*, leave the walls alone, *i.e.*, 'trust to the influence of the walls.'

XVII. 74.25.—*lui*, 'as for him, he.' The disjunctive pronoun is used here for the sake of emphasis.

XVII. 75.5.—*Des milliers de français*, thousands of Frenchmen. *mille* is an adj.; *millier* is a noun.

XVII. 75.16.—*fort au delà de ce que*, much beyond what.

XVII. 75.25 —*s'était réservé — disposer*, had reserved to himself the power of disposing.

XVII. 75.41.—*criaient au jacobinisme*, accused them of Jacobinism.

XVII. 77.15.—*n'en attachait pas moins d'importance*, attached none the less importance.

XVII. 77.18.—*aux saccades violentes*, by the violent jerks, the abruptness.

XVII. 77.23.—*un jour donné*, on an appointed day.

XVII. 77.25.—*il s'y complaît*, he takes delight in it.

XVIII. 78.29.—*certes—l'obtenir*, certainly it went the wrong way to obtain it.

XVIII. 79.40.—*il nous est à nous autres*, to the rest of us it is. See note on IX. 29.25.

XVIII. 80.14. *se permit des empiètements*, permitted to himself encroachments.

So also :—

XVIII. 82.9.—*il ne s'est jamais—attentat*, he has never permitted himself to authorise a conspiracy.

XVIII. 80.20.—*fit entièrement—Bonaparte*, made entirely a political blunder (*fausse route*) with regard to Bonaparte.

XVIII. 80.40.—*si ce n'est*, unless.

XVIII. 81.20.—*à quelque divinité qu' il l'adresse*, to whatever divinity he addresses it. See note on II. 8.14.

XVIII. 81.24.—*il se dit l'instrument*, he calls himself the instrument.

XVIII. 82.28.—*s'étaient fait alors le bizarre principe*, had then established for themselves the peculiar principle.

XVIII. 82.35.—*ne s'en tient pas toujours à la platitude*, does not restrict itself always to platitudes.

Most important points in French Grammar for revision before the examination :—

1. *Accents.* Look up words spelt alike, but distinguished by appearance or non-appearance of a certain accent, as *mur*, wall; *mûr*, ripe.

2. *Nouns.* Look up any rules you have in your grammars for the gender of nouns. Look up peculiar formations of feminines and of plurals. Look up nouns having two plurals in different senses as *aïeul*; pls. *aïeuls*, grandfathers; *aïeux*, ancestors.

3. *Adjectives.* Look up peculiarities in formation of feminine of adjectives. Look up adjectives usually placed before the nouns, and those which vary their meanings according as they placed before or after their nouns. Remember *bon* has comparatives *meilleur*; *mauvais* has comparatives *plus mauvais* and *pire*; *petit* has comparatives *plus petit* and *moindre*. *Et* in the formation of numbers appears *only* in *vingt-et-un* (21); *trente-et-un* (31); *quarante-et-un* (41); *cinquante-et-un* (51); *soixante-et-un* (61); *soixante-et-onze* (71).

4. *Pronoun. Notre, votre*, have *no accent* and pls. *nos, vos*; *le nôtre, le vôtre* have plurals *les nôtres, les vôtres*.

5. *Verb.* The Verb affords a fine field for the examiner, and will want great attention. We commence with the regular verb.

First conjugation. Learn peculiarities of verbs having *é* before their last syllable (as *espérer*, hope); those with *e* mute before their last syllable (as *mener*, lead), and those ending in *yer, cer, ger*.

Second conjugation.—The most puzzling point in this conjugation is to know where to put *iss*. It appears in the *present participle*; the *plural* of the *pres. ind.*; *all the imperfect ind.*, and *all the subjunctive*, except *the 3rd. pers. sing. of the imperf.*

Third conjugation (in *re*). *Battre*, and vbs. formed from it have only *one t* in the *sing.* of the *pres. indic.*, and the *second sing.* of the *imperative*.

Verbs in evoir (like *concevoir*). These are called *regular* by some grammarians. Learn the peculiarities of these well.

Formation of tenses of verbs. (*Very important.*)

Future.—The future tense of *all regular verbs* is formed by joining the endings of the present tense of *avoir* (*ai, as, a; ons, ez, ont*), to the infinitive of the verb. These are the endings of the future for *all French verbs*, but in irregular verbs they are often added to another root (as *pouvoir*; je *pourrai*).

Conditional.—To form the conditional for all French verbs, regular and irregular, take off from the future the terminations mentioned above, and replace them by the terminations of the imperfect (*ais, ais, ait; ions, iez, aient*).

Imperfect subjunctive.—The rule I am about to give applies to all French verbs, regular and irregular. From the preterite indic., take off the last letters of the 1st. and 2nd. pers. sing.; and the terminations *-mes, -tes, -rent* in the three persons of the plural. Add to these *-sse* and *-sses* for the 1st, and 2nd. persons sing.; and *-ssions*

-ssiez, -ssent for the three persons of the plural. For the third person singular add a *t* to the preterite indic., if there is none; and put a circumflex over the vowel preceding the *t*. In the 1st. conjugation change the *è* preceding *-rent* in the 3rd. pl. of the preterite into *a*.

Examples:—

Aimer, to love.

	Indic. Preterite		Imperf. Subj.	
	Sing.	Plu.	Sing.	Plu.
1.	J'aimai	Nous aimâmes	Que j'aimasse	Que nous aimassions
2.	Tu aimas	Vous aimâtes	Que tu aimasses	Que vous aimassiez
3.	Il aima	Ils aimèrent	Qu'il aimât	Qu'ils aimassent

Venir, to come.

	Indic. Preterite		Imperf. Subj.	
	Sing.	Plu.	Sing.	Plu.
1.	Je vins	Nous vinmes	Que je vinsse	Que nous vinssions
2.	Tu vins	Vous vintes	Que tu vinsses	Que vous vinssiez
3.	Il vint	Ils vinrent	Qu'il vînt	Qu'ils vinssent

Irregular verbs.—All the irregular forms in the author should be studied carefully. Students should be able to parse any of these verbs. We can give two little hints.

(*a*) *Venir, tenir*, and their derivatives, are alike in their irregularities.

(*b*) *Partir, sortir, sentir*, are also alike in their irregularities.

The other parts of speech will present but few etymological difficulties. In concluding this paper, I trust that students will find that it has enabled them to conquer some of the difficulties presented by the subject.

'IN 1999.'

A SCHOOL-PLAY FOR GIRLS.

By Joseph Despicht.

Characters and Dresses.

Doctor Brimful - - Principal of College.
(Black gown, red hood, college cap, spectacles.)

Professor Starlight - Lecturer on Astronomy.
(Black gown, blue hood, college cap.)

Professor Cookem - Lecturer on Domestic Economy.
(Black gown, blue hood, college cap.)

Ten (or more) Undergraduates - - - - -
(College caps, red or black gowns, white hoods, white collars.)

Monitor - - - - - - - - - - -
(College cap, red or black gown, white hood, white collar.)

Period of Play.—*The Year 1999.*

Scene.—*An Ordinary Lecture Room (Schoolroom), with high screens on right and left. Dummy Microphone on Right Screen; Dummy Telephone on Left Screen.*

Discovered.—*A Class of Undergraduates with long quill pens and enormous note-books. Also Doctor Brimful at a table or rostrum, on which are placed several large volumes. The Girls (Undergraduates), are chatting loudly.*

Doctor Brimful. Ahem! Ahem! (*Bangs long white wand loudly on floor, or stamps foot.*) A—hem!!! If the undergraduates of the first circle have quite settled their private affairs, I should like to proceed with the morning lectures. Let me see! (*Looks at enormous Time Table hanging on wall.*) At 9.30, Lecture on Ancient History by Doctor Brimful; at 10.30, Lecture on Astronomy by Professor Starlight, *through the Microphone*; at 11.30, Lecture on the Domestic Economy of the Savages of Timbuctoo by Professor Cookem, *through the Telephone*. I begin, then, with the Ancient History.

First Undergraduate. Doctor Brimful, it is my duty to inform you that, unless you make yourself much more interesting than you have lately, we, the undergraduates, have unanimously agreed to be very severe indeed with you!

All Undergraduates. Hear, hear! Hear, hear!

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[Undergraduates *take fresh note-books of enormous size and flourish long quill pens.*]

Professor Starlight (*from behind screen to right, and as if through dummy microphone*). Undergraduates of the first luminous circle, attention! Lecture on Astronomy number nine! Note-books ready! There are a great many stars—some of them twinkle, and some do not. Those of them that twinkle, twinkle; but those that do not, *don't*, and that's the difference.

Doctor Brimful (*still at his rostrum, and sharply*). Note that!

Professor Starlight (*as before*). Some of the stars are bigger than the others; these are the larger, the others are the smaller.

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Professor Starlight. Excuse me one moment, ladies. I have just discovered a new comet; I am going to measure its tail. Back in two minutes.

Doctor Brimful. How very tiresome! Professor Cookem begins very shortly! Put down your pens and repeat the Chinese poetry you learned for home-work!

Undergraduates (*with eccentric action of hands.*)

I.

Tsed Tsing-Tsing-Tsoo teou Tching-Tchang-Tchoo,
Whang junking dhown tse Hoang-Ho,
Gang twink-a-twank sum hullabaloo
Of Sarawak or sweet Ningpo.
Chin, chin! Chin, chin!

II.

Tso Tching-Tchang Tchoo of Loo-choo-foo
Twang-twink-a-twanked on ghold gong-gong
From Nan-jang-tang teou Ping-foo-choo,
From Shing-choo bak teou Gay-Hong-Kong!
Chin, chin! Chin, chin!

Professor Cookem (*from behind screen to left, and as if through dummy telephone*). It's half-past eleven, ladies. My lecture on 'The Domestic Economy of the Savages of Timbuctoo' is about to commence—note-books ready.

[Undergraduates *look first at telephone and then at clock.*]

Doctor Brimful. Oh, dear! Mr. Cookem's chronometer must be fast! It's only just eleven! (*Goes to dummy telephone and calls into it loudly.*) It's only just eleven—you must wait!

Professor Cookem (*as before*). I'm in Timbuctoo—my chronometer says half-past eleven—pay attention, first circle.

Professor Starlight (*through microphone as before*). Excuse me, the new comet *has no tail.* When I stopped I was about to say that—er—er—er—

Professor Cookem (*through telephone as before*). Savages generally roast one another before eating.

Doctor Brimful (*very loudly and sharply*). You must try to keep up with both!

[Undergraduates *make frantic efforts to use two note-books, while* Doctor Brimful *repeatedly cries,* 'Note that!' *As one voice dies away the other begins loudly.*]

Professor Starlight. There is a group of stars called the Great Bear—and—er—er—

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Professor Starlight. The sun shines out in all its splendour only when the fire has just been poked, and—er—er——

[*At this point both voices get together,* Starlight *and* Cookem *talking just as deliberately as before, but even more loudly. If one has finished first she can begin again, and so on, ad. lib.* Doctor Brimful *cries* 'Keep up! Keep up!' *and* 'Note that! Note that!' *till the hubbub is overwhelming.*]

(*The following is said simultaneously, but in small portions.*)

Starlight. And when more fuel is wanted they er—er throw on another star or two to keep the pot-a-boiling—er—er—It's no use throwing stars on the moon, because it only pitches them back again. When the moon wants to cut a shine it borrows a light from the sun—er—er—They are one shilling a packet and light only on the box—er—er—When it rains the sun can't lend what it hasn't got, so they both go out; that's what we call night—er—er—When it's not night it's day.

Cookem. And then they cook the goose's goose—er—er—And when it is well browned they take off the feathers to stuff it with—er—er— They baste it with Coat's unglazed sewing cotton—er—er, and serve it up on its head, which has previously been cut off—er—er—The female goose in Timbuctoo *is* a goose; but the male goose is *not* a goose, it's only a gander—er—er—They call it a gander because it is not goose enough to take the trouble to lay eggs—er—er— When the savage

-ssiez, *-ssent* for the three persons of the plural. For the third person singular add a *t* to the preterite indic., if there is none; and put a circumflex over the vowel preceding the *t*. In the 1st. conjugation change the *è* preceding *-rent* in the 3rd. pl. of the preterite into *a*.

Examples:—

Aimer, to love.

	Indic. Preterite		Imperf. Subj.	
	Sing.	Plu.	Sing.	Plu.
1.	J'aimai	Nous aimâmes	Que j'aimasse	Que nous aimassions
2.	Tu aimas	Vous aimâtes	Que tu aimasses	Que vous aimassiez
3.	Il aima	Ils aimèrent	Qu'il aimât	Qu'ils aimassent

Venir, to come.

	Indic. Preterite		Imperf. Subj.	
	Sing.	Plu.	Sing.	Plu.
1.	Je vins	Nous vinmes	Que je vinsse	Que nous vinssions
2.	Tu vins	Vous vintes	Que tu vinsses	Que vous vinssiez
3.	Il vint	Ils vinrent	Qu'il vînt	Qu'ils vinssent

Irregular verbs.—All the irregular forms in the author should be studied carefully. Students should be able to parse any of these verbs. We can give two little hints.

(*a*) *Venir*, *tenir*, and their derivatives, are alike in their irregularities.

(*b*) *Partir*, *sortir*, *sentir*, are also alike in their irregularities.

The other parts of speech will present but few etymological difficulties. In concluding this paper, I trust that students will find that it has enabled them to conquer some of the difficulties presented by the subject.

—o—

'IN 1999.'

A SCHOOL-PLAY FOR GIRLS.

By Joseph Despicht.

Characters and Dresses.

Doctor Brimful - - Principal of College.
(Black gown, red hood, college cap, spectacles.)

Professor Starlight - Lecturer on Astronomy.
(Black gown, blue hood, college cap.)

Professor Cookem - Lecturer on Domestic Economy.
(Black gown, blue hood, college cap.)

Ten (or more) Undergraduates - - - - - -
(College caps, red or black gowns, white hoods, white collars.)

Monitor - - - - - - - - - - -
(College cap, red or black gown, white hood, white collar.)

Period of Play.—*The Year 1999.*

Scene.—*An Ordinary Lecture Room (Schoolroom), with high screens on right and left. Dummy Microphone on Right Screen; Dummy Telephone on Left Screen.*

Discovered.—*A Class of Undergraduates with long quill pens and enormous note-books. Also Doctor Brimful at a table or rostrum, on which are placed several large volumes. The Girls (Undergraduates), are chatting loudly.*

Doctor Brimful. Ahem! Ahem! (*Bangs long white wand loudly on floor, or stamps foot.*) A—hem!!! If the undergraduates of the first circle have quite settled their private affairs, I should like to proceed with the morning lectures. Let me see! (*Looks at enormous Time Table hanging on wall.*) At 9.30, Lecture on Ancient History by Doctor Brimful; at 10.30, Lecture on Astronomy by Professor Starlight, *through the Microphone*; at 11.30, Lecture on the Domestic Economy of the Savages of Timbuctoo by Professor Cookem, *through the Telephone*. I begin, then, with the Ancient History.

First Undergraduate. Doctor Brimful, it is my duty to inform you that, unless you make yourself much more interesting than you have lately, we, the undergraduates, have unanimously agreed to be very severe indeed with you!

All Undergraduates. Hear, hear! Hear, hear!

Doctor Brimful. I am very, very sorry; and promise to do my best! If we turn to the nine hundred and ninety-ninth page of the ninth volume of Polly Pepper's 'History of the Nineteenth Century,' we shall see that, during the reign of Victoria Guelph, commonly called 'The Good,' the people were really little better than savages! They did not, we are told, actually eat one another; but such was their disregard of life, a great many men spent the whole of their time in producing weapons best calculated to destroy the lives of their fellow creatures!

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Doctor Brimful. For this reason: If two nations disagreed upon any point, instead of settling it, as we do, by a Committee of Elderly Ladies of both countries, they adopted the extraordinary method called 'War,' the chief peculiarity of which was, as far as I can learn, that by it each side alike suffered almost indescribable horrors!

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Doctor Brimful. Undoubtedly so, learnèd miss!

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Doctor Brimful. The only way we can account for such an absurd state of things is by the fact that, in those days the management of affairs was chiefly in the hands of men. Their natural stupidity and inherent brutality led them to regard fighting as the best means of settling a quarrel; but now that woman has at length gained her proper place in the world, we have altered all that! We never fight now. We only talk. Ahem! And so clearly and decisively is woman's superiority now recognised, that many female writers maintain that, according to the law of the survival of the fittest and the extinction of the weakest, the species of being called 'man' will soon *absolutely die out.*

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(*The following is said simultaneously, but in small portions.*)

Starlight. And when more fuel is wanted they er—er throw on another star or two to keep the pot-a-boiling—er—er—It's no use throwing stars on the moon, because it only pitches them back again. When the moon wants to cut a shine it borrows a light from the sun—er—er—They are one shilling a packet and light only on the box—er—er—When it rains the sun can't lend what it hasn't got, so they both go out; that's what we call night—er—er—When it's not night it's day.

Cookem. And then they cook the goose's goose—er—er—And when it is well browned they take off the feathers to stuff it with—er—er— They baste it with Coat's unglazed sewing cotton—er—er, and serve it up on its head, which has previously been cut off—er—er—The female goose in Timbuctoo *is* a goose; but the male goose is *not* a goose, it's only a gander—er—er—They call it a gander because it is not goose enough to take the trouble to lay eggs—er—er— When the savage

end when it's not day it's night, and when it's neither day nor night it's the afternoon, unless it's morning or evening, which very seldom happens. Richard Proctor says there are many suns—er—er—; but, of course, you need not believe what others say—er—er—*I've* only seen one, so there cannot be more—er—er—The Little Bear is a perfect nuisance, always twisting round on its tail—er—er—

parents have eaten up all the goose, the little savages fight for the rest, and seem to enjoy it amazingly—er—er—The goose must be very brown to be cooked—scratch that out—I mean the goose must always be cooked very brown, especially on the inside, which has been already drawn by a Special Artist. They call *him* 'Whistler,' because he whistles to the geese and then draws them—er—er—

At this point Doctor Brimful, *who is nearly exhausted, exclaims*—

Oh, dear! What shall we do? I shall go mad if this keeps on for an hour!

Undergraduates. We can't keep up with both!

First Undergraduate. I tell you what, madam, take my scissors and cut the communicating wires!

Doctor Brimful. Happy thought! I will!

(*Takes large scissors and pretends to cut wire of microphone. This instantly stops, while telephone still goes on. The Doctor then crosses stage and cuts wire of telephone, which also stops immediately—a few moments' pause*—Undergraduates *fan themselves with their note-books, while* Brimful *sinks into a chair.*)

Doctor Brimful. That's all right! What a relief! I wonder none of us thought of that before!

Bell rings. Enter a Monitor.

Monitor. If you please, madam, a telegram has just arrived which announces, of its own accord, that (*mentioning a well-known old scholar*) M—— N——, late Undergraduate of St. K— College, has just been returned Member of Parliament for Westminster.

[*Exit.*

Doctor Brimful. That's capital!

Undergraduates. Bravo! Bravo! Bravo!

Bell rings. Enter Monitor.

Monitor. Madam, a further telegram announces, in the Queen's own voice, that (*mentioning another well-known old scholar*) N—— M——, late Undergraduate of this college, has just been appointed Commander-in-Chief of the British Army in Jupiter.

[*Exit.*

Doctor Brimful. That's splendid!

Undergraduates. Bravo! Bravo! Bravo!

Bell rings. Enter Monitor.

Monitor. Professor Starlight, madam.

[*Exit.*

Enter Professor Starlight *brusquely.*

Professor Starlight (robed). Madam! I have been shouting away at my end of the microphone for the last ten minutes, till I was perfectly black in the face, and could get no answer to my query. So I jumped up behind a shooting star that was coming this way, and am here to know what you mean by such conduct.

Doctor Brimful. Really, Professor, I am very sorry, but you see—er—er—

Bell rings. Enter Monitor.

Monitor. Professor Cookem! [Monitor *remains.*

Enter Professor Cookem *brusquely.*

Professor Cookem (robed). Madam! I have made myself as hoarse as a crow, screaming away at my end of the telephone for the last ten minutes; and getting no answer to my questions, I slid down a sunbeam slanting in this direction, and am here to know what you mean by such shameful conduct?

Doctor Brimful. I am indeed very sorry, Professor, but you see, you were in Timbuctoo, and Professor Starlight, here, was in New York; and your telephone, and her microphone happened, by mistake, to be going at the same time, and we really couldn't stand it! So I simply cut the communicators! But I am sure you will forgive me when I tell you of the success of two of your old students. M——N—— has just been returned Member of Parliament for Westminster, and N——M—— has just been appointed Commander-in-Chief of the British Army in Jupiter.

Professors Starlight and *Cookem* together. We are delighted, Madam! Overjoyed! Enchanted! Three cheers for the Grand Old College!

Undergraduates (*speaking in gentle, ladylike tones*). Hooray! Hooray! Hooray!

Doctor Brimful. I'll tell you what, ladies; in olden times, and especially in Victoria's reign, when anything very joyful happened, those old-fashioned folks gave the children a half-holiday. I therefore beg you to revive the old custom, with a slight alteration, and give your poor professors one.

Undergraduates. Oh, certainly, with pleasure! You dear old fogies may go and play for the rest of the day.

Professors (*rubbing their hands, and then throwing up their caps*). Bravo! Bravo!

[*They run out helter-skelter—the rest bow. Professors return and bow.*]

CURTAIN.

—o—

SPENCER'S 'EDUCATION.'

BY THOS. CARTWRIGHT, B.A., B.SC. (LOND.),

Author of 'Mental Science and Logic for Teachers,' Co-Director of the Birkbeck Training Classes.

CHAPTER II.—INTELLECTUAL EDUCATION.

'SOME centuries ago there was uniformity of belief—religious, political, and educational. All men were Romanists, all were Monarchists, all were disciples of Aristotle, and no one thought of calling into question that grammar-school routine under which all were brought up.' But the march of progress has given the death-blow to this 'unanimity of the ignorant,' and educationists are now in the throes of that contentious struggle which marks the second of the three phases, through which all opinion, educational and otherwise must pass, as through fire, viz.: 'the disagreement of the inquiring,' and 'whatever may be thought of theological dissent, it is clear that dissent in education results in facilitating inquiry by the division of labour.' Ultimately this inquiring spirit will, it is hoped, be able to discover the true method, and to demonstrate its truth so clearly as to bring about the educational millennium to be characterised by the 'unanimity of the wise.' The difference between the Old and the New Education is well expressed by Quick in the following words: 'The Old Education had one object, and that was learning. Man was a being who learnt and remembered. Education was a process by which he learnt, at first, the languages and literatures of Rome and Greece only; but, as time went on, the curriculum was greatly extended. The New Education treats the human being not so much as a learner as a doer and a creator. The educator no longer fixes his eyes on the object—knowledge—but on the subject—the being to be educated. The success of the education is not determined by what the educated *know*, but by what they *do* and what they *are*. . . When we have ascertained what are the faculties to be developed, we must consider, further, how to foster the self-activity that will develop them.'

The leading contrasts between the Old Education and the New, as given by Spencer, may here be conveniently summarised:—

(1) Both mind and body are to be fully developed. Man must be made a 'good animal.' 'The best brain is found of little service if there be not enough vital energy to work it.'

(2) Rote-learning is falling into discredit, and associations of reasoning are relied upon in memory-training instead of mere verbal associations, as was formerly the case. 'To know by heart is not to know,' *i.e.*, so long as the words are indispensable, their content is not truly known.

(3) Rule-teaching is now condemned as producing an appearance of understanding without the reality. The upward progress from particulars to generalisation (Inductive or Analytic method) is more and more

preferred. 'While the rule-taught youth is at sea beyond his rules, the youth instructed in principles solves a new case as readily as an old one.'

(4) 'Abstractions are left untaught until the mind has been familiarised with the facts from which they are abstracted.' Hence grammar should not be taught to children ; but respecting this, see below.

(5) Sense-training is systematically practised. Hence the well-conceived but ill-conducted system of *object-lessons.*

(6) Presentation of truths in the concrete is thus ousting the old method of presenting them in the abstract.

(7) Acquisition of knowledge is being made pleasurable, and not painful as heretofore.

Reflection upon the above yields a series of educational maxims or guiding principles, which are as finger-posts, indicating what the general complexion of the new method may be expected to be. In brief, they are as follows :—

(*a*) In education we should proceed from *simple to complex.*

(*b*) Mind-development advances from the *indefinite to the definite.*

(*c*) Lessons ought to *start from the concrete and end in the abstract.*

(*d*) The education of the child must accord both in mode and arrangement with the education of mankind, considered historically. This is the principle which Condillac, followed by Comte, enunciated, and it is a legitimate inference from the doctrine of evolution. Hence 'education should be a repetition of civilisation in little.'

(*e*) In each branch of instruction we should proceed *from the empirical to the rational.* Language should precede grammar, and here, as in all cases, the rules, principles or generalisations should be built up by inference from the facts yielded by observation or experiment. 'The mind should be introduced to principles through the medium of examples.'

(*f*) Self-development should be encouraged to the uttermost. Children should be *told* as little as possible and induced to *discover* as much as possible. The efficacy of this is proved by the success of the self-made man. It is the natural method, and courage, perseverance, and concentration result from it : outside help is most valuable when it does not anticipate difficulties, but steps in when patient effort is baffled.

(*g*) Healthy action is pleasurable, hence healthy education calls forth happy activity. If interest, which is another word for pleasure, be absent, there is something wrong about the method. If it be present there is no necessity for artificial stimuli, and a healthy co-operation between teacher and taught, begetting mutual respect and esteem, may be confidently anticipated.

(*a*) This may also be taken to include *from the known to the unknown*, although Spencer makes no mention of this maxim. Its truth is uncontestable.

(*b*) Experience teaches the truth of this principle, and to set out with crude notions, which are made clear by the correction first of greatest, and then successively of less marked errors, is a course which we must be content to follow. 'The normal state of a child's knowledge is that of confusion, vagueness, and indefiniteness.' (Prof. W. H. Payne.)

(*c*) Concerning this Quick sagely remarks : 'In conformity with this principle, Pestalozzi made the actual counting of things precede the teaching of abstract rules in Arithmetic. Basedow introduced weights and measures into the school, and Mr. Spencer describes some exercises in cutting out geometrical figures in cardboard as a preparation for geometry. The difficulty about such instruction is that it requires apparatus, and apparatus is apt to get lost or out of order. But if apparatus is worth anything at all, it is worth a little trouble. There is a tendency in the minds of many teachers to depreciate 'mechanical appliances.' Though such appliances will not enable a bad teacher to teach well, nevertheless, other things being equal, the master will teach better with them than without them. There is little credit due to him for managing to dispense with apparatus. An author might as well pride himself on being saving in pens and paper.

(*d*) Nothing further need be added under this head.

(*e*) As to this Sully says : 'The chief differences between empirical and scientific knowledge are the following :—(1.) The former is based on a narrow range of observation, and on observation which is apt to be loose and inexact ; the latter on a wide survey of facts and on accurate processes of observation and experiment. (2.) The former consists of propositions which have only a limited scope, and are never, strictly speaking, universally true ; the latter is made up of propositions of wide comprehensiveness, and of universal validity, known as principles or laws. (3.) As a result of this the conclusions deduced from empirical knowledge are precarious, whereas the conclusions properly drawn from scientific principles are perfectly trustworthy.'

(*f*) The fact that we take most delight in the work of our own hands is sufficient warrant for this principle. Hence the wise teacher encourages his children to question him, and endeavours to get one boy to answer the questions asked by another. Hence, also, the charm of practical science and manual work of all kinds which provide an outlet for the ever-present yearning for activity. That 'we learn to know by doing' is another proof of the soundness of this rule.

(*g*) Everybody admits the desirability of this, although it is not easy to see how it is possible to make all subjects, which must be taught, directly pleasurable to children. If uninteresting in itself, the subject should be shown to be interesting in its results, or borrowed interest should be infused by sympathy which might beget a transference of enthusiasm from teacher or classmate ; but all training should endeavour to culminate in the infusion of a love of knowledge for itself ; for, 'Perhaps a love of knowledge for its own sake, or a confirmed taste for intellectual improvement is the highest and most comprehensive motive that the teacher can seek to establish' (Prof. W. H. Payne). 'In the study, as elsewhere, pleasure could not be continuous and unmixed. There, as everywhere, it must be bought by effort, painful, perhaps, at the time ; but there, as everywhere, it serves as a reward for the activity which has so happily expended itself, and as encouragement for the activity which lends itself to the renewal of effort. Such is the universal law' (Prof. Joly).

In the course of this second essay, Mr. Spencer has discussed, more or less fully, Object Lessons, Drawing and Grammar, and has drawn certain comparisons between the theory and practice of Pestalozzi. As to Object Lessons he rightly advocates letting the objects speak as much as possible for themselves, and depre-

cates the stultifying of such lessons by the teacher's 'telling'; in addition he recommends a greater extension of these lessons, both as to subjects and as to the classes to be included in this teaching.

Grammar, as above noted, is to be taught inductively by means of the language with which the child is already furnished, and should not be taken in the lower standards. With respect to both these subjects Spencer's views are thoroughly sound, and they are everywhere bearing fruit, as is proved by the object teaching of the vast majority of our schools, and by the popularity of teaching Grammar by way of sentence-forming and word-building; furthermore, the Phonic System, which is also advocated (p. 62), is daily becoming more popular in our elementary schools, and we *do* teach the multiplication table experimentally, and actual weighing and measuring are now by no means uncommon as a prelude to calculations involving weights and measures. With regard to Drawing, Mr. Spencer puts forth the suggestion that procedure from the known to the unknown is the rational course to follow, and he is undoubtedly right. From experience we can corroborate Mr. Spencer's contention, that the drawing course of South Kensington—which is exactly the same as that promulgated by 'John Bell, Sculptor,' in his 'Outline from Outline, or from the Flat'—is a dismal failure, when carried out on the lines indicated in the authorised 'Syllabus.' It is least interesting where interest is most wanting, viz., in the earlier stages, and it defeats its own purpose, for the substitution of doors and gates and windows, etc., for lines, angles, and geometrical figures, as in Kindergarten drawing, enables the necessary ideas to be given in an interesting form; whereas the 'simple to complex' method, exemplified in commencing from lines, is as uninteresting as it possibly can be. The adoption of Mr. Spencer's views, supported as they are by the practice of Professor Tyndall, would, in our opinion, be productive of unalloyed good.

Again, as to Pestalozzi, Mr. Spencer is in strict agreement with all educationists when he applauds the greater part of the theory of that giant amongst educationists, whilst condemning some of his practices. The greatness of Pestalozzi is undoubted, but it rests not upon his methods, but upon his aims, and these were unquestionably perfect. 'The essence of Pestalozzionism lies not so much in its method as in its aim; not more in what it does than in what it endeavours to do.' 'Tried by modern standards, Pestalozzi's Schools were failures. The order was pitiable, and the positive instruction was slight. All his days he was groping his uncertain way after a "method." He felt intensely, but he saw obscurely. His benevolence, generosity, and goodness were boundless, and so was his credulity. . . Without denying Pestalozzi the merit of having made some contributions to method, it is perfectly hopeless to account for his greatness on this score. It is the spirit of the man, and not his method, which entitles him to a pre-eminent place among the great names in the history of education.' Comparing the course of infant education, as set out in the 'Mothers' Manual,' with the course of exercises in those elementary and unanalysable sensations, which can only be learnt by actual experience, and which necessarily constitute the first beginnings alike of knowledge and of mental development—it is not difficult to see that Spencer's course would be in accord with Pestalozzi's aims, whilst Pestalozzi's mode of procedure sins against the most fundamental of his principles as savouring more of 'abstract' than 'concrete,' more of 'words' than of 'things,' more of 'instruction' than of 'education,' more of 'knowledge' than of 'development.'

The educationists quoted by Spencer, in addition to Pestalozzi and his assistants, are:—Huxley, Marcel, Montaigne, Bacon, De Morgan, Wyse, Comte, Fellenberg, Tyndall, and Horace Mann.

Huxley has done, and is doing, much to secure the recognition of Science as an important item in the curriculum. He strongly advocates the teaching of Earth knowledge or Physiography as a 'preliminary opening of the eyes to the great spectacle of the daily progress of Nature,' to be followed by Botany and Physics, to which he would add 'somewhat of Chemistry and an elementary acquaintance with Human Physiology,' a scheme which, unlike that of Spencer, it would be possible to carry out without cramming.

Marcel (1793—1876) was French Consul at Cork. He educated his nine children himself. He zealously studied methods of education, and in 1853 Messrs. Chapman and Hall published his book, entitled 'Language as a Means of Mental Culture.' Spencer's quotation, 'Education,' p. 59, is the first of Marcel's twenty 'Axiomatic Truths of Methodology.' These may be found in the Appendix to Quick's 'Educational Reformers.' Nos. 7, 8, and 14 are here quoted as specimens of the rest.

(7) Instruction should proceed from the known to the unknown, from the simple to the complex, from concrete to abstract notions, from analysis to synthesis.

(8) The mind should be impressed with the idea before it takes cognisance of the sign that represents it.

(14) What the learner discovers by mental exertion is better known than what is told him.

Montaigne (1533-1592) was a brilliant French essayist. His educational thoughts and suggestions are to be found in his 'Essay on Pedantry.' He contended that knowledge is not the chief thing for education to aim at, and that true knowledge is something very different from knowing by heart. He thus sounds the key note of the Development Theory. 'We may become learned from the learning of others; wise we can never be, except by our own wisdom.'

Bacon's 'Novum Organum,' in which we are taught 'to conquer Nature by obeying her,' was the first step towards systematising and popularising the Inductive Method. His influence upon educational methods was due to this. The strength of this influence may be judged from the fact that Comenius, the father of realism in education, was a professed disciple of 'the noble Verulam, who has given us the true key to Nature!' De Morgan's Arithmetic is replete with suggestions as to the intelligent teaching of the whole of this subject.

Of Wyse, nothing need be added to Spencer's quotations.

Comte (1798-1857), the apostle of Positivism, was an eminent French psychologist, whose philosophy is now generally discredited. It is by no means certain that he must be credited with the discovery of the principle that 'the education of the child must accord, both in mode and arrangement, with the education of mankind, considered historically,' as it had already been set forth by Condillac in his 'Grammaire.'

De Fellenberg was a contemporary of Pestalozzi, and for a time the administration of Pestalozzi's establishment was in the hands of 'this man of iron,' but this was most uncongenial to Pestalozzi, who therefore left the institution and settled at Yverdun. Fellenberg established agricultural institutions for children both in Switzerland and in this country, in which he put into practice his belief that activity is pleasurable.

Of Tyndall nothing need be said to English teachers, and of Horace Mann it is only to be noted that he is an eminent American educationist.

The following questions have been set on Spencer's Education to Certificate Students.

1890. (6) 'How does Spencer classify the leading kinds of activity which constitute human life?'

For answer see table in October number.

(7) In what sense does Spencer use the word 'Science'? and how does he justify the reply he makes to the question, 'What knowledge is of most worth?' Say if in any respects the reply appears to you to be inadequate, or requires any addition.

Science is used by Spencer as indicating 'the order of knowledge underlying the right performance of those processes by which civilised life is made possible.' It is concerned in the establishment and exposition of those invariable laws which underlie the uniform co-existences and sequences of phenomena, so that 'learning a business implies learning the science involved in it.'

He justifies his opinion by showing that all arts have a related science, upon which they are founded, and that a man can do best when he can understand and explain the laws to which his practice conforms.

The reply is inadequate because it mainly refers to a money-getting usefulness; the 'complete living,' which should culminate in loftiness of spirit and nobility of aim, is closely linked with the emotional or æsthetic side of mind, and, just as philanthropy laughs at the laws of Political Economy, excellent though they be in the vast number of cases, so 'the complete life requires more training on the emotional side than is supplied by Science, and this would, in part, be supplied by Literature and History. To this end Payne gives the following division of:—

Education Values

(1) Practical (2) Disciplinary (3) Culture

and Spencer makes small provision for (3).

To give some idea of what (3) includes, the following quotation from Campayré's 'History of Pedagogy' is given 'To cause gross natures to pass from the life of the senses to the intellectual life; to make study agreeable, to the end that the higher pleasures of the spirit may struggle successfully against the appetites for material pleasure; to put the book in the place of the wine-bottle; to substitute the library for the saloon—in a word, to replace sensation by idea; such is the fundamental problem of popular education.'

(8) How is the general principle that we should, in teaching, 'proceed from the simple to the complex' explained and illustrated either in Mr. Spencer's book or in your own experience?

Spencer would see that an infant had ample opportunity for receiving the simple sensations when quite young, and upon these he would build in the examination of objects. In teaching reading, by first giving the powers of letters, and then by combining them into words, and by building up the multiplication table and other arithmetical syntheses the same principle is illustrated. Beginning with the school and leading up to the geography of the world, and taking a local historical event as a starting point in teaching history, are other illustrations.

1891. What does Spencer think of Montaigne's doctrine 'to learn by heart is not to learn at all'? Reproduce the argument employed in connection with this saying.

He says that learning by rote is daily falling into discredit. *Proofs:* (1) Mechanical way of learning alphabet condemned; (2) Multiplication table is taught experimentally; (3) Languages learnt by imitation, Grammar last; (4) Battersea Reports—'Preparatory Instruction, chiefly oral—appeals to Nature (resulting in associations of reasoning) common.'

In rote system the importance of symbols is magnified, and the thing signified consequently lost sight of. To repeat words correctly was everything, their meaning was nothing; hence, 'savoir par cœur n'est par savoir.'

Discuss Spencer's views on Pestalozzi, and on Drawing as an instrument of education.

For answer, see above.

What is self-evolution? and how does the author illustrate and express his arguments on this head?

Self-evolution means self-development, by means of exercise congenial and suitable.

Humanity has progressed by self-instruction, and success of self-made men shows that this is still the true method; acquisition of knowledge by children under school-age, and out-of-school knowledge of boys in general and street-arabs in particular, are other illustrations. Hence, induce the child to discover, and refrain from telling, and so, by a skilful ministration, the mind will be made as self-developing in its later as it was in its earlier stages. Disgust for knowledge is the result of dragging the child from facts which he can digest, and cramming him with those for which he has no liking.

How does Spencer's views of the discipline of consequences help a teacher in the conduct and moral government of a school? And in what way, if any, does that view seem to you inadequate?

It helps because it is sometimes practicable, as in the cases given below:—

Offence.	Punishment.
Late-coming	Late-going
Careless work	Doing it again
Waste of school time	Loss of leisure time
Invasion of rights and comforts	Loss of privileges
Injury to property	Restitution

It is inadequate because of its remoteness and because of its undue severity in many cases. If a boy lies, the natural punishment would be universal discredit and distrust at some distant period. This would not act as a present deterrent, and is, moreover, too severe a punishment for an offence which was probably, to a great extent, due to thoughtlessness and ignorance. Hence an artificial punishment which will be speedy, and which may act as an immediate deterrent, is the wise and humane course to pursue.

In conclusion, we give half a dozen questions upon the subject of the two Essays, and we shall have much pleasure in correcting and returning at once any

answers which readers of the PRACTICAL TEACHER may see fit to send to Pilgrim Street.

(1) Spencer says that we 'all have a restless craving to impress our individualities upon others.' How does he endeavour to prove this, and what remedy would he apply for the removal of this craving?

(2) 'There is knowledge of intrinsic value; knowledge of quasi-intrinsic value, and knowledge of conventional value.' Discuss and illustrate this statement.

(3) What does Spencer say as to the connection between Poetry and Painting, and Science? State any objections to his contentions.

(4) What conclusions does Spencer draw from the Bushman, the Red Indian, the Accountant, and the Wild Boy of Aveyron? Discuss these conclusions.

(5) Give the substance of Spencer's remarks on Object Lessons, History, Grammar, or Drawing.

(6) How does Spencer illustrate 'from the known to the unknown'? Give one or two illustrations from your own experience.

——o——

NOTES AND NOTIONS.

BY RICHARD WADDINGTON,

Ex-President of the Half-time Council of Teachers.

THE Assistant Teachers' Conference is an evidence of the change in the condition of the teachers during the last decade. Not many years ago, at least the Civic authorities would have been inclined to say—

> 'You are too bold:
> Go to; I'll make ye know your times of business.'

The line of demarcation between the head and assistant is rapidly being obliterated. Only a few years ago the possibility of assistants meeting in conference seemed hardly possible. I congratulate the assistants, and especially Mr. President Hardy, on the success of the Nottingham meeting.

* * * * *

I BELIEVE in the organisation of sections of the profession. The Union has, in the past, gained much from such organisations. The Half-time Council and the Rural Confederation have done much to bring their special difficulties nearer solution through the parent organisation. But the basis of all such confederation ought to be membership of the N.U.T. The Union can, and will, do much for the assistant teacher. What is required is the expression of the grievances, with definite information on which action can be taken.

* * * * *

WHILE I am with the assistants let me congratulate Mr. Peaker on the paper on 'Salaries.' The tone is incisive and conclusive, without being in any sense extravagant. But there is one factor omitted by Mr. Peaker. Assistants coming out of college, anxious to return from whence they came, offer to take salaries below the scale. The market is to some extent 'rigged' by the 'stop-at-home' assistant, and until something is done to make this *infra dignitatem*, amelioration of the position of the assistant is impossible.

> This secret is so weighty, 'twill require
> A strong faith to conceal it.

Is it true that in one district where the Inspector is strong on the 'Ball Frame,' so great has been the demand for these useful articles that the manufacture cannot keep pace with the demand?

Is it true that under one School Board the teachers have to take charge during the dinner interval in turn?

Is it true that under one School Board the *annual* increase comes every three years?

Is it true that some Drawing Inspectors are demanding *every* child to be promoted at least one standard each year?

Is it true that another Inspector set an open umbrella as the model for Standard VI?

* * * * *

THE action of the London School Board in combining girl and infant departments under one head teacher is neither in the interest of the teacher, the scholar, nor the State. Economical rather than educational results are anticipated from this eccentric move. In the North of England the mixed schools are growing; but the mixture is that of boys and girls above the infant department. Infant-school teachers have for years been looked upon as a speciality, and rightly so. The methods and organisation of a school for older children differ very much from the methods and organisation of a good infant school. How is one head teacher to properly organise a school containing 700 or 800 scholars between three and fourteen? Educationally the move is a bad one, but professionally it is still worse. The chance of promotion is already a small one, but this will seriously curtail it.

* * * * *

THAT interesting and precocious pupil who is always said to date from a Board School is now in Cardiff, and is said to have turned out the following piece of original composition:—'King Henry 8 was the greatest widower that ever lived. He was born at Anne Domino in the year 1066. He had 510 wives, besides children. The first was beheaded and afterwards executed, the 2nd was revoked. She never smiled again. But she said the word "Calais" would be found on her heart after her death. The greatest man in this reign was Lord Sir Garret Wolsey. He was sir named the Boy Bachelor. He was born at the age of fifteen unmarried. Henry 8 was succeeded on the throne by his great grandmother, the beautiful and accomplished Mary Queen of Scott, sometimes known as the Lady of the Lake, or the Lay of the Last Minstrel.'

* * * * *

NEXT session of Parliament will be an interesting one. What will the Government do with superannuation? Failing legislative effort by the Government, Sir Richard Temple has promised to move a resolution calling on the Government to give effect to the recommendations of the Select Committee. Doubtless Mr. Acland's heart will be with Sir Richard; but, with the Chancellor of the Exchequer to reckon with, his vote may be against him.

Then there is the question of the qualifications for labour. Here there is greater hope. The Union has decided to draft a bill for Sir Richard to introduce, codifying and simplifying the various Acts bearing on the subject. The main purport of the Bill will be the

substitution of 'Age and Attendance' for 'Age and Standard.' With a long pull, and a strong pull, and a pull all together, we may place on the Statute Book a very useful measure during 1893.

* * * * *

FRANCE has loyally kept the pledge given at the International Congress held at Berlin. The new French law regulating the employment of women and children in factories has just been promulgated. It applies to all women and children not employed at home under the direct supervision of their parents or guardians. No child is to work in a factory or workshop who is under the age of thirteen, and only then if medically certified as fit to do so. The only exception is for children of twelve who hold certificates of having passed the primary course of instruction. The law provides that young persons under sixteen may be re-examined by a medical man if there is doubt as to their physique. Even Spain has fulfilled the terms of the compact which Sir J. Gorst, representing England, was so anxious to bring about in the interest of the 'physical, moral, and intellectual welfare' of the rising generation. Yet, England lags behind.

* * * * *

THE following extract from a letter which I received from Monsieur Richard Waddington, who had charge of the bill in the Senate explains the advance of the new law on the old:—

'According to the present law, which remains in force till the new bill takes its place, children from ten to twelve were allowed to work in specified industries (thirteen in number, among which were the various spinning-mills, glass-works, etc.). From twelve upwards they are allowed to work full hours if they can produce a school certificate showing they have passed a certain standard (the standard is a very elementary one). If this certificate is not forthcoming they can only work half-time as long as they are under fifteen, after which age there is no further control.

'Practically, these rules did not work well. In many cases mill-owners were allowed to substitute for the regular school attendance two or three hours' teaching, given in a special class attached to the factory. The young hand there learnt very little, and had to work eight, or sometimes ten, hours a day.'

Surely if the Frenchman, in the interest of his offspring can take so great a step, the Englishman can do likewise.

* * * * *

AT Russell Square from 9.30 a.m. to 8.20 p.m. was the record of the members of the Executive who attended the last meeting—at least, some of them. The rooms are being fitted with the electric light. It would seem that sleeping accommodation will be wanted next. No wonder Mr. Sinclair has had enough. The long meetings and the long journeys take the enthusiasm out of even the youngest. Every one of their colleagues regret Messrs. Le Manquais and Sinclair's retirement. I am sure their love for the work has not abated one jot, but at the present pace the life of a member of the Executive, especially a provincial member, must be short, if not merry.

* * * * *

HAS it ever struck you that the intelligence of your children might be very greatly improved by the posting of a query, day by day, on a blackboard? Something like the following:—

QUESTION.

WHY DO WE FIND INCREASED COLD AS WE REACH HIGHER ALTITUDES?

Try it; and change the question at regular intervals.

It is but a more extended form of the old plan that existed before 'payment by results' drove everything that would not reduce the errors in spelling to ·0001 per child out of the school. I can remember that under the old plan we had half a dozen such questions dictated, and wrote the answers. As a scholar I enjoyed it, and I am sure it increased our general knowledge.

* * * * *

THERE can be no doubt that the teacher is more ready to lay his case before the public than in the past. Public meetings called by teachers are not so rare as they were formerly. At a very successful public meeting in Bolton, presided over by the Mayor, several very striking results from the public ventilation of educational difficulties were apparent. First, the superannuation of teachers was supported by an artisan who was bold enough to assert—'No matter how much they paid for education it was cheap.' Next, a working-man member of the School Board spoke strongly against 'Child Labour.' And lastly, two clergymen, managers of large voluntary schools, spoke out strongly against 'Extraneous Duties,' and a member of the School Board advocated better pay for the assistants. And this was in halftime-ridden Bolton!

* * * * *

A BURNING question of National importance is the right of the teacher to reasonable protection from capricious dismissal. How can it be accomplished? Years ago we demanded the right to appeal to the Department. Well, taken at its usual pace the Department would form a rather slow Court of Appeal. The decision reinstating the teacher would often arrive after he was superannuated. I like the Department better now than I ever did before, but I don't like it well enough to turn it into a Court of Appeal, unless I cannot help it. Besides, going to the Department would be extremely cheap for the manager, and not always safe for the teacher. Supposing the Department decided that a teacher was inefficient, there could only be one result, and that would be the withdrawal of the certificate.

* * * * *

WHAT, then, would you appeal to? The ordinary law courts. Let the teacher have an agreement on the lines of the Pupil Teachers, and let the Government insist on every teacher only being recognised on the staff when the agreement is duly executed and presented to the Inspector. Let the agreement state

specifically the reasonable grounds for dismissal, and then the teacher could appeal to the ordinary legal tribunal in case the agreement was broken. This is, to my mind, the proper solution. It would be expensive—that is greatly in its favour, because the managers would hesitate ere setting it in motion. Of course it would be expensive for the teacher, but the teacher in Union need not fear that. It might be as slow as the Department, but you could always get an injunction to prevent the dismissal, pending the issue.

* * * * *

BUT there is another side to the question. If there is appeal against the manager dismissing there must be appeal for the manager against the teacher leaving. So long as the present system of paying grant exists there must be periods when the changing of teachers would be highly disadvantageous to the school. Again, putting all question of grant aside, the argument which is most powerful against the capricious dismissal of the teacher is the fact that he is doing such admirable work. This cuts both ways, and the teachers would be asked to give the managers reciprocal rights with themselves. Are they prepared to go so far? If not, I am afraid we must walk circumspectly on the way to a Court of Appeal.

* * * * *

I HEARD a very funny story about security of tenure. A prominent member of the Union was very much interested in what appeared likely to result in the dismissal of an old and able teacher, because of the advent of a new vicar 'Who knew not Joseph.' Calling on the teacher on the Friday night, he found the master hopeful, his wife sorrowful. Next morning the managers were to meet to decide the fate of the teacher. The wife felt, and the visitor felt the accuracy of her judgment, that the other managers would simply record the parson's will. On the morrow the visitor 'hung about' until the conclusion of the meeting, when the teacher came out radiant with smiles. 'Well, how's the voting?' said the visitor. 'Five for my retention, one against.' But how's that; they hardly look men who would stand against the vicar?' 'Let me tell you a secret,' says the master. 'I knew they wouldn't dismiss me. *I owe each of them twenty pounds.*'

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LONDON MATRICULATION.

JANUARY, 1893.

OUR PREPARATION CLASS FOR PRIVATE STUDENTS.

BY T. RUSSELL MALTBY, M.A.
Kingswood School, Bath.

(SIXTH MONTH.)

The next examination for Matriculation will commence on *Monday, January the 9th.* Candidates must therefore apply to the Registrar *not later than Monday, December the 5th*, for Forms of Entry; and these must be returned not later than *Monday, December the 12th*, accompanied by Certificates of Age and by Fees.

When our readers have completed the course indicated below they will have covered the ground of the January Examination. We shall publish next month our concluding notes on Horace and Euripides, and hope to give also notes on the June papers and a number of Model Answers selected with the view of guiding, as far as possible, candidates who are about to meet the London examiners for the first time.

Courses for December.

I.—LATIN.

1. *Allen's Grammar, Sects. 301-393, and Revision of Sects. 59-153.*

2. *Allcroft and Haydon, Exercises I.-X.* (three or four of the C sentences in each).

3. *Horace, Odes, Book III.* Revise translation and notes, look up allusions, and pay particular attention to the *quantities* of words.

4. *Translation at Sight. Hardy's Reader, Nos. 175-177, 208-210, 220-222, 229, 230.*

II.—GREEK.

1. *Abbott and Mansfield's Accidence. Revision of Verbs*, using the lists at the end of the book.

2. *Abbott and Mansfield's Syntax, Sects. 167-197.*

3. *Heracleidae, 1-866.* Revise the translation of difficult passages, study the contemporary allusions, and parse all difficult forms.

4. *Translation at Sight. Colson, Pt. IV., IX.; Pt. V., VI., X.; Pt. VII., I.; Pt. VIII., I., II.*

II. FRENCH.

1. *Breymann's Grammar, Chapters VI.-X.* (Numerals, Adverbs, Prepositions, Conjunctions, Interjections).

2. Revise Breymann on *Pronouns.*

3. *Anecdotes Historiques et Littéraires, Livre Quatrième, Nos. 6, 11, 12, 15, 19, 21, 24, 33, 35.*

4. *Word Lists.* Continue, and revise.

III.—ENGLISH.

1. *Grimm's Law. Mason, pp. 219-221,* and *Hewitt and Beach, pp. 649-651.*

2. *Mason, Sects. 454-499* (Summary of the Rules of Syntax), *with the more difficult exercises on pp. 257-260, and references to H. and B.*

3. *Punctuation and Analysis,* using Mason, Sects. 601-611 and 500-600.

4. *Ransome's History, 1660-1702, with the Geography relating thereto.*

IV. MATHEMATICS.

1. *Arithmetic.* Matriculation questions.

2. *Algebra. Hall and Knight, Chapters XXXIII. and XXXIV.*, and Matriculation questions.

3. *Euclid, Hall and Stevens, Books II. and III.* Revision.

V. MECHANICS.

Wormell, Chapters XVI.-XVIII. (Specific Gravity, Air and Gases). Work out some recent London papers.

VI. CHEMISTRY.

Remshead. Revision. *Briggs's Synopsis* will be serviceable at this stage.

VI. HEAT AND LIGHT.

Stewart's Light, Chapters VIII.-X. (Dispersion, Velocity, Instruments, and Experiments). Answer some of the London questions given in the Appendix. Dr. Wormell's lectures on *Heat* and *Light* are very clear and interesting (1s. each).

RECENT EXAMINATION OF A VILLAGE SCHOOL.

THE school whose latest examination by Her Majesty's Inspector is here recorded is a Village School for girls in an agricultural district situated in a Western county. The staff consists of a trained Mistress and one Assistant.

The Inspector arrived punctually at ten o'clock, and proceeded at once to examine the singing throughout the school. 'Swinging,' a two-part song by T. P. Cowling, and the round, 'Great Tom is Cast,' were chosen as the song tests for the upper standards. Note-singing on the Tonic Sol-Fa Method was next examined. The Inspector asked the Assistant Mistress, who had taught the singing on this method to all the standards, to take the Modulator exercise for Standards V. and VI., and show how they could sol-fa transition passages. When this had been done he wrote on the blackboard the following exercise in the minor scale :—

l se l m d' t l m l d' t l.

When the girls had sung this test, the Inspector went to Standards III. and IV., and wrote on the blackboard the passage :—

d s m d' s fe s l t d' d' ta l t d'.

He then asked the girls to sing the chord, and then sol-fa the exercise. Next he wrote on the blackboard this time-form—

| : : | : : | : : | : : |
| : : ‖

and asked the children what measure he had written, and how many measures were shown. On being told, he asked how they beat three-pulse measure, and one girl was called out to do it for him. He then put in the notes thus :—

|1 :1.1 :1 |1 :1 :— |1 :1 :— |1 : : |
|1.1 :1.1 :1 ‖

and told the children to look at it well, and called out a girl to show him where they were not to sing at all, and say how many beats they were to keep silent. The teacher was then asked to beat one measure, and the children were then required to commence and sing the exercise to the syllable *lah*.

Standards I. and II. were next examined, and after hearing the children sing one song called 'Gliding,' by T. P. Cowling, the Inspector asked the teacher to give a Modulator exercise.

The two lower standards were then given needle-work to do, while the Inspector gave out arithmetic and dictation to the upper standards. In Standards I. and II. the sums were dictated; in all the others they were worked from cards.

STANDARD I.

Arithmetic.—

1. Add 498, 637, 885, 96, 78.
2. From 804 take 77.
3. Take 247 from 391.

ANSWERS.—(1) 2,194 ; (2) 727 ; (3) 144.

Mental Arithmetic.—Each child was asked separately all round the class such questions as—5×4, 6×3, 4×7, 7×3, 2×5, 3×8, 5×9, 5×8, 6×6, 2×7, 4×3, 3×9, 4×8.

Writing.—'Tom and Martha lived in a house on the bank of a river.'

Reading.—This was heard from the 'Royal Readers.' No questions were asked on the meanings.

Recitation.—The piece recited was 'Lizzie and the May.' Such questions as these were asked :—

What is meant by 'Winning the kiss'?

Who wins the kiss? What is the prize won?

Grammar.—Course A of this subject had been prepared, and the teacher was asked to question the class. The Inspector asked the children to tell him the subject in the following sentence :—

'In the field were three cows.'

STANDARD II.

Arithmetic.—

1. Multiply 67,985 by 704.
2. Divide 80,010 by 9.
3. From 60,701 take 3,294.

ANSWERS.—(1) 47,861,440 ; (2) 8,890 ; (3) 57,407.

The teacher was asked to find the answers to these sums, and mark the slates herself.

Dictation.—'Often the hunters approach quite near to a tiger before they see it, as the striped skin of the animal is so like the colour of the forest grass.

Reading was heard from the 'Royal Readers.'

Grammar.—Questions on the Subject and Predicate were asked by the teacher, and afterwards the Inspector asked the girls to tell him the subject of the sentence, 'In the field I saw three cows.'

Recitation.—'Keeping his word.' Questions on the meanings, etc., were asked by the teacher.

Mental Arithmetic.—40 pence = ; 49 pence = . How many threepenny-pieces can I get for a shilling? How many sixpences? How many sixpences for half-a-crown? How many half-crowns in half-a-sovereign? Which is the larger coin? Which would you rather have?

STANDARD III.

Reading.—This was from the Historical Reader.

Dictation.—'He searches about among the rocks and cliffs, and cuts off with great care the nicest sponges he can find and puts them under his arm or into a sack. When he has gathered as many as he can he pulls the rope, and the men in the boat haul him and his load of sponges up to the surface as quickly as they can.'

Grammar.—What is a sentence? What is a full predicate?

'Over the hills sank the sun.'

'A boy clung to the tree.'

'The poor man hit the dog gently.'

Enlarge the subject and object in the above sentences.

Recitation.—The piece prepared was Hood's 'Song of the Shirt.'

Who was supposed to be singing the song?

What does 'respite' mean?

What does the author mean by 'unwomanly rags'?

Why would it be unwomanly for any woman to be in rags?

What does she mean by saying 'a walk would cost a meal'?

Arithmetic.—

1. 8,960,743 ÷ 609.

2. £78,906 17s. 11¾d. − £9,961 19s. 11½d.

3. A girl has £5 to lay out. She gives 19s. for a dress, 6s. for a bonnet, 5s. 11d. for boots, and then gives 5s. to her mother. How much has she left?

4. John has £3 7s. 5½d. and James 12s. less than John. How much have they together?

ANSWERS.—(1) 14,713 + 526; (2) £68,944 18s. 0¼d.; (3) £3 4s. 1d.; (4) £6 2s. 11d.

STANDARD IV.

Reading.—The girls read from the Historical Reader.

Dictation.—The passage was taken from a book the Inspector brought with him. It contained the following words:—Manor, furniture, chamber, present, moth, tenant, blocked, window-tax, prey, worm.

Grammar.—Analyse: 'And in each pillar there is a ring.'

Recitation.—The 'Prisoner of Chillon' was taken by this Standard in conjunction with Standards V. and VI.

Arithmetic.—1. An estate of 120 acres was bought at the rate of £150 per acre and sold at £175 per acre. What was the total gain?

2. A farmer employs ninety men and thirteen boys. The men get 15s. each, and the boys 3s. 3d. each per week. How much will he have to pay for all the wages for four weeks?

3. Multiply £893 17s. 6¾d. by 870.

4. How many stones are there in 7 tons 282 lbs.?

ANSWERS.—(1) £3,000; (2) £278 9s.; (3) £777,673 19s. 4½d.; (4) 1,140 stones 2 lbs.

Mental Arithmetic.—If a postman walked twenty miles a day and got 6d. a mile, how much would he get in a week?

How many yards in a mile and a half?

What part of a pound is a penny? a halfpenny? a farthing?

What part of a foot is half an inch?

500 articles at half-a-crown each.

500 articles at 4s. each.

If 5 articles cost 35s., what would 7 cost?

N.B.—Half the girls had the above, and the other half had to work the following tot:—

£	s.	d.
4,706	17	4½
57,896	14	11¼
28,143	19	7¼
40,569	18	9¾
35,235	15	11¼
1,060	10	5
6,327	16	8¾
12,458	3	6¼
£186,399	17	4

STANDARD V.

Recitation.—'The Prisoner of Chillon.'

Grammar.—Analyse and Parse:—

(*a*) 'I saw it silently decline.'

(*b*) 'He was a hunter of the hills.'

(*c*) 'To him this dungeon was a gulf.'

Composition.—Labour-saving.

'An Irishman was once set to dig a public well, and after digging about twenty yards he went home. On returning to his work the next morning he found, to his dismay, that during the night the sides of the well had given way, and, falling in, had filled the hole to the top. This to a man who was not over fond of work was very disheartening; but after thinking for a few minutes he hit upon a plan which would help him. Looking cautiously round, and seeing no one about, he took off his hat and coat, and placed them on a stick at the side of the well. He then hid himself behind some bushes. Later on in the day some neighbours, passing that way, saw the hat and coat lying on the ground, and were much concerned at not seeing the man anywhere. They came to the conclusion that he must be buried at the bottom of the well, so they fetched others to help them, and began to dig it out again. After digging till they got to the bottom, they were puzzled to think what had become of the body, as they could not find it in the well, when the Irishman stepped from behind the bushes and thanked them heartily for the labour they had saved him.'

Arithmetic.—1. £28 4s. is divided among 9 men and a certain number of women. Each man had £2 7s., and each woman 15s. 8d. Find the number of women.

2. If I pay £2 for 1 cwt. and sell it at 5d. per lb., how much shall I gain if I sell 8 cwt. 3qrs. 20 lbs.?

3. Bring 5 miles 814 yards to chains.

4. How many years, weeks, etc., are there in a million minutes?

ANSWERS.—(1) 9 women; (2) £2 19s. 6⅔d; (3) 437 chains; (4) 1 year 47 weeks 1 day 10 hours 40 mins.

Mental Arithmetic as in Standard IV.

STANDARD VI.

Recitation.—'The Prisoner of Chillon.' The first fifteen lines were repeated by all the girls in the upper standards together, the rest individually. The following questions were asked:—

Who wrote this poem?

Who is Lord Salisbury?

Which would you rather be—Lord Salisbury or Lord Byron?

Which one is living now?

Would you rather be a poet or a statesman?

What poet has just died?

Tell me the name of another poem written by Lord Byron.

Who was the famous Prisoner of Chillon?

Grammar.—Analyse and Parse:—

(*a*) 'The ship in which we sailed arrived.'

(*b*) 'When the boy got home he found his father there.'

Composition.—

(*a*) An essay on 'Fruits.'

(*b*) An essay on a journey to the nearest town. How you got there, what you saw when you were there, and how you came back.

Arithmetic.—1. If 84 lbs. of tea cost £2 12s. 6d., what would 1½ lbs. cost?

2. Bring 2½ pecks to the fraction of 2½ bushels.

3. If a farmer pays £17 8s. for 14½ acres, how many can he buy for £76 5s. 6d.?

4. Bring 1½ cwts. to the decimal of 5·25 lbs.

ANSWERS.—(1) 11¼d.; (2) $\frac{5}{56}$; (3) 63 ac. 2 rds. 10 pls.; (4) 320.

Mental Arithmetic was taken with Standards IV. and V.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

BY R. A. GREGORY, F.R.A.S.

Author of 'Physical and Astronomical Geography' and 'Elementary Physiography.' Honours Medallist in Physiography; Oxford University Extension Lecturer.

THE topics to be dealt with this month are those contained in the third section of the Syllabus of Advanced Physiography, viz. :—

Gravitational Energy.—Interaction of mass upon mass (gravitation). Measurement of the earth's density; methods employed and results obtained. Effects of the gravitational energy of celestial bodies on the earth. The form of the earth's orbit, and its varying speed during revolution round the sun. Combined effect of the sun and moon on the ocean; the tides and their effects. Precession; nutation; changes in the line of apsides.

These subjects will be found to be treated in the following sections of the text-books recommended:—'Lockyer's Elementary Lessons,' Chapter ix. pp. 293-324; 'Young's Lessons,' Sects. 220-222, 119-122, 125, 126, 428-430, 208-215.

Nature, May 23, 1889, contains an article by me on 'The Determination of Masses in Astronomy,' which should be consulted when possible.

The Geology necessary to answer the questions at the end of the notes will be found in 'Elementary Physiography,' Chapters XIII-XV.

Laws of Motion.—Full explanations of the laws which govern the movements of bodies are given in my Elementary Physiography. Clerk Maxwell states the laws as follows:—

(1) Every body perseveres in its state of rest or of moving uniformly in a straight line, except in so far as it is made to change that state by external forces.

(2) Change of motion is proportional to the impressed force, and takes place in the direction in which the force is impressed.

(3) Re-action is always equal and opposite to action, that is to say, the actions of two bodies upon each other are always equal and in opposite directions.

The first law asserts that a body cannot move of itself, and that if it is once set in motion it will go on for ever, unless some force prevents it from doing so. From the second law, we see that whatever the number of forces which act on a body, each produces its full effect, and the direction of motion is the resultant of all the actions.

The third law shows that there are two ways of looking at every action, for each body can be considered to act upon the other. All action is therefore in the nature of stress.

Law of Gravitation.—Again, following Clerk Maxwell, we define Newton's Law of Gravitation as follows:—

'Every portion of matter attracts every other portion of matter, and the stress between them is proportional to the product of their masses divided by the square of their distance. Let f represent the gravitational stress, m and m^1, any two portions of matter in the universe, and d the distance between them; then the law of gravitation can be expressed algebraically in this manner:—

$$f = \frac{m \times m^1}{d^2}$$

Gravity.—Bodies fall on account of the attraction stress between them and the earth. The momentum (mass × velocity) of a falling body is equal to the momentum its attraction generates in the earth. Common experience tells us that a stone let fall from a bridge increases in velocity until it reaches the earth's surface. Scientific observation shows, that if a body move from rest towards the earth, then—

At the end of 1 second its velocity is 32 feet per second.
" " 2 seconds " " 64 " "
" " 3 " " " 96 " "
" " 4 " " " 128 " "

It will be seen that a velocity of 32 feet per second is superadded to the original velocity during every second of motion. This is known as the 'acceleration due to gravity.' Calling this g, the velocity of the falling body at any instant v, and the number of seconds of motion t, we get the equation—

$$v = gt.$$

Hence, knowing the acceleration of gravity and duration of motion, the velocity of a body can be calculated.

Space, Acceleration, and Time.—The space traversed by a falling body is also connected with acceleration and time. In the case of a body moving from rest under the action of gravity, we have:—

At the beginning of the 1st second, the velocity is 0.
" " " 5th " " " 128 ft. per sec.

The acceleration may be taken as uniform; hence the average velocity during the first four seconds is $\frac{128}{2} = 64$ feet per second. If the average velocity of a train is known, the distance which the train would travel in a given time can easily be found. In like manner, the average velocity of a falling body having been found as above, the space traversed can be obtained by multiplying it by the duration of motion.

Let S = space traversed; g velocity at the end of the first second of motion; t the duration of motion in seconds. Then the above result is expressed algebraically as follows:—

Velocity at beginning = 0
" " end = gt
Average velocity = $\frac{gt}{2}$

Therefore, space traversed = $\frac{gt}{2} \times t$

That is, $S = \frac{1}{2} gt^2$.

Hence, In 1 second a body travels over 16 feet
" 2 seconds " " " 64 "
" 3 " " " " 144 "
" 4 " " " " 256 "

Gravitational Stress between the Earth and Moon.—The earth attracts bodies towards its centre, and the effect of the action is termed weight. Whether on the summit of a mountain, or at the heights attained by balloonists, the attraction of the earth is felt. But as the distance from the earth's centre is increased, the force of attraction diminishes in intensity.

Pendulum observations show that the force varies inversely as the square of distance from the earth's centre. Why should not this rate of diminution exist beyond the regions which are accessible to us? Assuming that it did so, Newton was able to calculate the intensity of the attraction stress at the distance of the moon (240,000 miles). The radius of the earth is about 4,000 miles in length, so a body at the moon's distance is sixty times further removed from the earth's centre than a body on the earth's surface. Consider the body at rest. The attraction of the earth would set it in motion, and during the first second it would move through a distance much less than the sixteen feet, which represents a body's fall in a second at the earth's surface. In fact,

$$\text{The fall per second} = \frac{16}{60^2} = 0{\cdot}0044 \text{ feet.}$$

That is to say, the fall of the body towards the earth is 0·0044 feet in one second.

But the moon is not at rest, it moves round the earth in 27⅓ days, in an orbit the size of which is determined by the earth's attraction. The fraction 0·0044 feet represents the amount by which the portion of the orbit traversed by the moon in one second differs from a straight line. The angle through which the moon moves in one second is given by the proportion:—

27 days, 7 hours, 43 minutes, 11 seconds : 1 second :: 360° : x

Whence $x = 0°{\cdot}5$

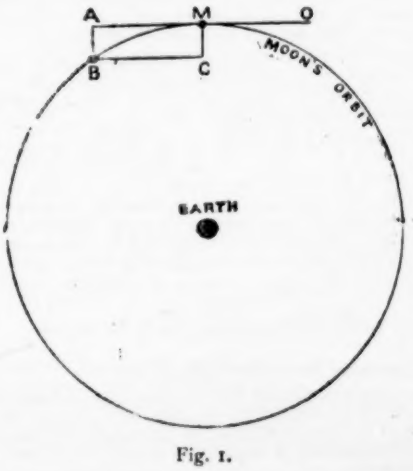

Fig. 1.

Fig. 1 illustrates this point in a greatly exaggerated form. Let M represent the moon and E the earth, and let the moon's original velocity be such, that if the earth did not exist, its satellite would travel from O to M or M to A in, say, one second. Now imagine

the earth to come into existence when the moon is at M. Then instead of reaching the point A, the moon appears in the position B at the end of a second, having travelled in the direction MB. The distance AB or MC therefore represents the fall of the moon towards the earth in one second. The earth pulls the moon towards itself, the moon has an original, straight-line velocity, and the result of the combination of action is that our satellite strikes a mean, as it were, between the two, and describes a curve.

Kepler's Laws.—About 1610 Kepler, from a discussion of the observations of Tycho Brahe, formulated three laws of planetary motion, which can be stated as follows :—

(1) The orbit of each planet is an ellipse, the sun being at one of the foci of each ellipse.

(2) The line joining the centre of a planet to the centre of sun (the radius vector) sweeps over equal areas in equal times.

(3) The squares of the times of revolution of all the planets are proportional to the cubes of the mean distances from the sun.

These laws apply equally well to the motions of satellites round their primary planets. The first law has already been referred to ; but explanations of the meaning of the two remaining laws will now be given.

Kepler's Second Law.—It follows from this law that any body in orbital revolution moves fastest when nearest its primary and slowest when most distant. Let the ellipse of Fig. 2 represent the

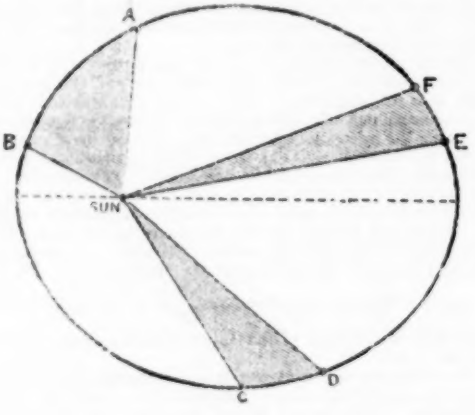

Fig. 2.

orbit of a planet or satellite, and let AB, CD, and EF represent the distances traversed by the body in question in a fortnight. The shaded portions of the figure are the areas which the radius vector passes over in each case, and Kepler's second law asserts that these areas are all equal to one another. At the time of discovery, it was now known why this should be the case ; but Newton proved that the law of gravitation fully accounted for the motion.

Kepler's Third Law.—This, also known as 'The Harmonic Law,' gives precisely the relation that exists between the motion and distances of bodies revolving round each other. It is expressed in the form of a proportion as follows :—

Square of Period A : Square of Period B :: Cube of Distance A : Cube of Distance B

where A and B represent any two planets.

Suppose, for example, a planet is found to have a period of ten years ; its distance from the sun, in terms of the distance of the earth or any other planet, can be calculated. Let us take the case of the earth for the comparison. Then we have

$$(1 \text{ year})^2 : 10^2 :: 1^3 : \text{Dist.}^3$$

$$\text{Hence Dist.}^3 = \frac{10^2 \times 1^3}{1^2} = 10^2 = 100$$

And, therefore Distance $= \sqrt[3]{100} = 4{\cdot}6$.

Hence, the hypothetical body is at a distance from the sun 4·6 times the mean distance of the earth, and hence, if the absolute distance of the earth is known, the distance of any other planet can be calculated as soon as its period of revolution has been obtained by observation.

The following table contains the squares of the periods and the cubes of the distances of the chief planets, with the period and distance of the earth as unity :—

Planet	Distance	Period	(Distance)^3	(Period)^2
Mercury	0·38	0·24	0·05	0·05
Venus	0·72	0·62	0·37	0·38
The Earth ..	1·00	1·00	1·00	1·00
Mars	1·52	1·88	3·54	3·54
Jupiter	5·20	11·86	140·61	140·70
Saturn	9·54	29·46	868·33	867·89
Uranus	19·18	84·02	7065·79	7059·36
Neptune	30·13	164·78	27108·14	27152·45

It will be seen that though the fourth and fifth columns run together they are not identical. The variation between them is due to the fact that the distances and periods given in the second and third columns have not been taken beyond the second decimal. But even when the values found by the most elaborate means are square and cubed, there is a slight variation between the two series of products, proving that Kepler's third law, though an extremely close approximation, is not rigidly accurate. The smaller the planet the less is the difference, and the law is absolutely true for a material particle having a mass so small that it can be neglected.

The Density of the Earth.—The earth's radius (r) being known, its surface and volume can be calculated by means of the relations

$$\text{Surface} = 4\pi r^2 \qquad \text{Volume} = \tfrac{4}{3}\pi r^3$$

where $\pi = 3{\cdot}1416$.

But these measures give no idea as to the earth's mass, that is, the quantity of matter it contains ; or its density, that is, its weight compared with a sphere of water having the same size. A number of determinations of the earth's density have been made, different observers adopting different methods. The mass of the earth is equal to the product of density into volume. The chief methods will now be described.

The Schichallien Experiment.—The theory of this experiment is as follows : Let za, z^1b, Fig. 3, represent the direction of two plumb-

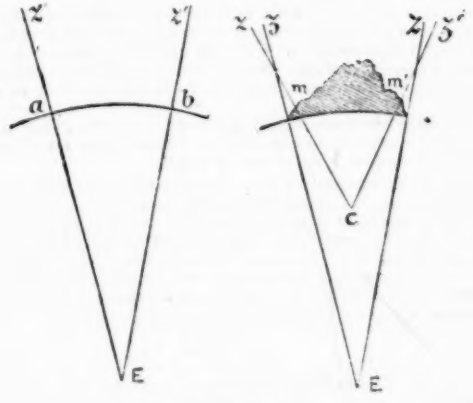

Fig. 3.

lines hung at a and b respectively. Knowing the inclination of these directions to each other, and the distance ab, the position of the point E can be calculated. Now, imagine that a mountain could be created and placed upon the plain ab, the mountain would attract the plumb-lines out of the vertical, and make them take up the directions, zm z^1m^1, and these lines would meet at C. The deviation from the true direction therefore represents the resultants of the pulls of the mountain and the earth. The size of the mountain can be measured, the average density of the rocks composing it can be found by experiment ; hence the mass can be calculated. This being done, we have the following problem : A mountain of a known mass causes a certain deflection of the plumb-lines ; what mass is necessary to counteract entirely the pull of the earth ? The mass thus found will be equal to the mass of the earth.

In 1774 Maskelyne made some observations near the Schichallien Mountain in Scotland, with a view of obtaining the required data. By means of a zenith sector, the astronomical difference of latitude between two observing stations was found. Calculation showed what the difference would have been had no local attraction existed. The observed difference exceeded the calculated by 11″·6. The

mountain was then measured, and its volume estimated. The ratio of the attraction of the earth to the attraction of a body as big as the earth, made up of the same materials as the mountain, was afterwards estimated, and found to be as .9933 is to 1. We thus get :—

Attraction of Earth : Attraction of Mountain :: 206,265″ : 11″·6
That is :: 17781 : 1.

Hence—

$$\frac{\text{Attraction of real Earth}}{\text{Attraction of fictitious Earth}} = \frac{17781}{9933} = 1{\cdot}79.$$

The average density of the rock which make up the mountain was found by experiment to be 2·8.

Therefore, Density of Earth $= 2{\cdot}8 \times 1{\cdot}79.$

$= 5{\cdot}012.$

The Earth's Density from Pendulum Observations.—It has been abundantly proved that the intensity of gravitational stress varies inversely at the square of the distance from the earth's centre. The intensity at any point above the earth's surface can therefore be calculated. A pendulum is kept in vibration by the attraction of the earth, and applying the law of gravitation, the slowing down which would follow if it were removed to any point higher in the atmosphere can be found. But the value obtained would only be true if the pendulum could be set in vibration in the air, away from all local influences. This state of things is of course impracticable. We can, however, find the rate of vibration at the bottom and at the top of a mountain. The rate at the top will be quicker than it would have been, had the mountain not existed. And the difference between the observed and theoretical values is produced by attraction of the mountain. If, therefore, the mass of the mountain is found by measurement and experiment, and the effect of the mass upon a pendulum rate is determined by observation, the action of a similar mass of the same size as the earth can be estimated by proportion. The earth's density is then deducted from this as in the case of the Schichallien experiment.

Another method is to find the rate of a pendulum at the earth's surface and in a mine. If the earth had the same density throughout, like a billiard ball, a seconds pendulum at the surface would lose when taken down a mine, on account of the fact that the shell of rock above it has no action in causing the vibrations. Observations show that such a pendulum beats quicker ; hence the earth increases in density as its centre is approached. Assuming the rate of increase to be uniform, the average density and the mass of the earth can be found.

The Earth's Density determined by means of a Balance.—Dr. Poynting has obtained some good results by very simple means. A delicate balance has a spherical mass of lead and antimony suspended from each of its arms. A much larger mass of the same alloy is then brought in turn beneath the balanced spheres. When the attracting mass is on one side, the sphere above it is pulled slightly down ; when on the other side, the companion sphere is pulled down. The attraction stress between the mass and each sphere is thus measured. The weights of the spheres give the value of the earth's attraction upon them, and the density of the earth can then be calculated in the same manner as that described in the following method :—

The Cavendish Experiment.—At the end of last century Cavendish determined the earth's density by what is known as the 'torsion-balance' method. Two small lead balls of known weights are rigidly connected by a rod. The rod is suspended by a fine thread attached to its centre, and comes to rest in a certain position. Two massive lead balls are now brought alongside the small balls in such a manner that their attraction tends to twist the fine thread. The small balls are pulled out of their original direction, and the amount of deviation is measured. From this the effect which would be produced if the large balls were of the same size as the earth is calculated. The weight of each of the small balls is a measure of the earth's attraction. Hence we get the proportion :—

Attraction of a lead ball of the same size as the earth : Attraction of the earth :: Density of the earth : Density of lead.

And, substituting the results of observation, 2 : 1 :: 11·4 : density of earth.

Whence density of earth $= 5{\cdot}2$.

The experiment can also be viewed from the following aspect :—

The earth's diameter is about 40,000,000 feet, and since the volumes of cubes vary according to the cubes of their diameters, the attraction of a sphere of the same mean density as the earth is $\frac{1}{(40{,}000{,}000)^3}$ of the earth's attraction. A sphere of lead one foot in diameter exerts about twice this attraction ; hence the density of the earth is about half that of lead.

Cavendish's experiment in a modified form has been carried out by several eminent investigators. Professor Cornu suspends the rod on which are fixed the two small balls, between four hollow globes, situated at the corners of an oblong. The globes at the extremities of one of the diagonals are first filled with mercury and the deflection of the suspended beam observed. They are then emptied, the two remaining globes are filled, and the deflection in the opposite direction is measured. The advantages of this ingenious method over that of Cavendish's are obvious. Professor Boys has devised an entirely new arrangement, in which one of his famous quartz fibres is utilised, but space will not permit its description here.

Summary of Results. The following is a statement of some of the results obtained :—

Deflection of plumb-line at Schichallien	4·713
" " " " Arthur's Seat	5·316
Pendulum observations at Mont Cenis	4·950
" " " Harton Coal Pit	6·565
Torsion balance method (Cavendish)	5·480
" " " (Baily)	5·660
" " " (Cornu)	5·530
Common " " (Poynting)	5·493

From this it will be seen that the earth is about 5·6 times heavier than if it were composed of water. The earth's mass is the product of this number into the earth's volume.

Mass of the Sun.—The determination of the mass of the sun involves the following considerations :—

Moon's fall towards the earth = 16 ft. in one minute.

Earth's fall towards the sun = 35 ft. in one minute.

But the earth is 386 times nearer the moon than the sun ; hence, correcting for distance, so as to compare the two falls or accelerations :—

$$\text{Moon's fall at sun's distance} = \frac{16}{386^2} \text{ ft. in one minute.}$$

$= 0{\cdot}000108$ ft. per minute.

We see, therefore, that the sun's force of attraction produces an acceleration of 35 ft. per minute on the earth ; the earth would produce an acceleration of 0·000108 ft. per minute on the moon if it were as far away as the sun. Hence

Sun's mass : earth's mass :: 35 : 0·000108.
That is, as 323,000 is to 1.

The accuracy of the determination depends upon our knowledge of the distances of the sun and moon.

Masses of Planets.—If m represent the mass of any planet, M the mass of the sun, a the mean distance, and T the period of the planet, while a^1 and T^1 are similar terms for a satellite, then

$$\frac{m}{M} = \left(\frac{a^1}{a}\right)^3 \left(\frac{T}{T^1}\right)^2$$

Using this formula, the following results have been obtained :—

Mars, from observations of his two satellites				$\frac{1}{3{,}100{,}000}$
Jupiter	"	"	" his four	" $\frac{1}{1047}$
Saturn	"	"	" two of his	" $\frac{1}{3{,}500}$
Uranus	"	"	" his four	" $\frac{1}{22{,}000}$
Neptune		"	" his only	" $\frac{1}{19{,}380}$

In the cases of the planets without satellites, Venus and Mercury, a different and much less exact method of procedure is used, depending upon the mutual disturbances of these planets, and the disturbance which the earth produces on their motions.

Masses of Satellites.—The best method of obtaining the masses of satellites is to measure their disturbances upon each other. This has been done with some success for the satellites of Jupiter and Saturn, but not for any of the others.

Masses of Stars.—Only double stars can have their mass determined. Let m and m^1 be the masses of the two components of a double star ; M, that of the sun ; a the angle, expressed in second, which is subtended at the earth by the semi-major axis of the satellite's orbit ; p the 'annual parallax' of the binary group ; T the time in years of one revolution of the satellite, then the following formula holds good :—

$$\frac{m + m^1}{M} = \left(\frac{a}{p}\right)^3 : T^2$$

The Moon and Tides. The following circumstances point to a connection between the moon and tides :—

(1) The average interval between two alternate times of high water or of low water is 24 hours 51 minutes, which is the time that intervenes between two successive meridian passages of the moon.

(2) Twice a month, soon after new and full moon, high water reaches a higher mark than usual (spring tides), and twice a month, about the times of the first and last quarters of the moon, the tides are less full than the average (neat tides).

Differential Action.—The cause of tides is the difference of attraction of the moon and sun on the solid earth and on the water nearest and farthest from them. The differential attractions, or tide-producing effect of both bodies, are compared as follows:—

Distance of sun = 33,142 times the radius of the earth.
Distance of moon = 60 times the radius of the earth.
Mass of sun = 332,000 times the mass of the earth.
Mass of moon = 0·0125 of the mass of the earth.

$$\text{Thus differential attraction of sun } (S) = \frac{332{,}000}{(23{,}141)^2} - \frac{332{,}000}{(23{,}143)^2}$$

$$\text{And differential attraction of moon } (M) = \frac{0{\cdot}0125}{(59)^2} - \frac{0{\cdot}0125}{(61)^2}$$

$$\text{Hence, } S : M :: \left(\frac{332{,}000}{(23{,}141)^2} - \frac{332{,}000}{(23{,}143)^2}\right) : \left(\frac{0{\cdot}0125}{(59)^2} - \frac{0{\cdot}0125}{(61)^2}\right)$$

From this we find—

Sun's effect : Moon's effect :: 2 : 5.

At spring tides the sun and moon act together; at neap tides they oppose each other. Hence—

Spring tide : Neap tide :: 5 + 2 : 5 − 2. That is as 7 : 3.

Obliquity of the Ecliptic.—The earth's orbit undergoes various changes with the lapse of centuries, due to the disturbing effects of the sun, moon and planets. In the first place, the obliquity of the ecliptic is gradually diminishing. It will decrease in value for a long period and then increase. The total variation of 1° 20′ takes place in a period of about 10,000 years. Assuming that this is the only change to which the earth's orbit is subject, its chief effect would be as follows:—

(1) A progressive movement of the line of equinoxes along the celestial equator.

(2) A decrease of the right ascensions and longitudes of stars, for both are reckoned from one of the points where the equinoctial line pierces the sky.

(3) The latitudes of stars are changed; for they are reckoned from the plane of the ecliptic, and could only be perpetually true if the plane were fixed.

(4) The amplitudes of the sun at sunrise and sunset experience a slight variation.

Luni-solar precession.—What is known as luni-solar precession is produced by the attraction of the sun and moon upon the equatorial protuberance of the earth. The chief effects of this perturbation are as follows:—

(1) The direction of the line produced by the intersection of the planes of the equator and ecliptic has a retrograde movement along the ecliptic of 50·2″ a year.

(2) The longitude of stars increases by about 50″ yearly.

(3) The right ascensions and declinations of stars experience a slight variation, but the latitudes of stars are not affected.

(4) Each celestial pole describes a circle, with a radius of 23°½ round the poles of the ecliptic, in 25,800 years.

Precession of the Equinoxes.—The disturbing effect of the moon and sun, plus the effect produced by the planets, is termed the 'precession of the equinoxes.' The general result is:—

(1) The line of equinoxes has a retrograde movement, which takes it completely round the celestial sphere in 25,800 years.

(2) The tropical year is shorter than the sidereal year by about twenty minutes.

(3) The celestial poles remain 23°½ distant from the poles of the ecliptics, but describe circles round them in 25,800 years.

(4) The declinations of stars vary in a period of 25,800 years, the maximum variation being 47°.

(5) The changes of declination cause the amplitudes of rising and setting of stars to vary in the same period.

(6) The signs of the zodiac have a retrograde movement, through the constellations of the zodiac.

(7) The right ascensions and longitudes of stars are increased.

(8) The seasons which occur when the earth occupies a certain position in its orbit are changed, and move completely round the orbit in 25,800 years.

Nutation.—The precession of the equinoxes varies in amount from day to day. Instead of the direction of the earth's axis describing a proper circle round the poles of the ecliptic, it describes a wavy line. This small oscillation of the earth's axis, known as nutation, is caused principally by the moon's action. On account of it:—

(1) Each pole of the earth (and therefore the celestial poles above them) describes the circumference of an ellipse having a major axis 18½″ in length in 18·6 years, while the centre of the ellipse steadily travels in a retrograde fashion round the pole of the ecliptic in 25,800 years.

(2) The declinations of bodies change slightly in a period of 18·6 years, and their longitude and right ascensions alternately increase and decrease in the same time. But nutation does not affect the position of the ecliptic plane, and therefore does not cause the latitudes of stars to vary.

The Apse-Line of Line of Apsides.—This is the line connecting the perihelion and aphelion points of the earth's orbit. It has a direct motion of 11·77″ per annum, but its length, 184,000,000 miles, is constant. On account of this motion and the retrograde motion of the equinoctial line (50″ per annum), the perihilion points and the solstices are separating by about 62″ yearly, and the lengths of the seasons are variable. The apse-line will only coincide with the line of solstices once in 21,000 years, this number being obtained by dividing 360° by 62″.

Eccentricity of Orbit.—The length of the line of apsides is constant; hence any change in the eccentricity of the earth's orbit must be due to a variation in the length of the minor axis. Shorten this axis, and the orbital eccentricity is increased; lengthen it, and the eccentricity is decreased. The eccentricity of the orbit is now decreasing. If the decrease were to go on continuously, the orbit would eventually become circular, and all the seasons would be equal in length. Calculation shows that the decrease will go on for about 24,000 years, and then an increase of eccentricity will set in. This variation of eccentricity, like the variation in the position of the apse-line, must cause great climatic changes on the earth.

Questions set by the Science and Art Department.

1. State the methods used in determining the density of the earth. (1892.)
2. What are the causes and what are the effects of the precession of the equinoxes? (1886.)
3. The sun's attraction at the earth's surface is much greater than that of the moon, yet the moon is the more important agent in producing tides. State the exact reason of this. (1889.)
4. Explain why the influence of the moon is greater than that of the sun in causing tides. (1888.)
5. Why is the influence of the moon on the tides greater than that of the sun? (1887.)
6. State Kepler's laws. (1886.)
7. How are the tides caused, and what is meant by 'Spring' and 'Neap' tides? (1885.)
8. What is meant by the precession of the equinoxes? (1883.)
9. State what you know about Kepler's laws. (1881.)
10. State what you know about nutation. (1878.)
11. Explain the precession of the equinoxes. (1877.)
12. How has the mass of Jupiter been determined? (1888.)
13. Describe the chief results obtained when a sounding is made in the deeper parts of the ocean. (1892.)
14. Why were the old soundings in the deep ocean unsatisfactory? What is the essential principle of the modern apparatus for determining the depth of the ocean? Give a sketch of one of these pieces of apparatus. (1891.)
15. How has the temperature of the deeper parts of the ocean been determined? State what you know of the temperature of the ocean at different depths. (1890.)
16. What are the organisms that have the power of separating silica from sea-water, and what is the nature of the deposits formed by these organisms? (1888.)
17. How are the deposits known as 'Diatomaceous ooze' and 'Radiolarian ooze' respectively formed? (1887.)
18. What is the cause of the low temperature which prevails at the bottom of the deep oceans? (1881.)

Questions on the Notes.

1. What is the cause of the precession of the equinoxes, and how are the apparent positions of the stars affected by its operation?
2. Prove by means of Kepler's second law that the power which keeps the planets in their orbits is directed towards the sun.
3. How is the mass of the sun determined?
4. What is the period of a planet whose mean distance from the sun is three times the earth's mean distance?
5. What variations do the seasons on the earth undergo in the course of ages, and what are the chief causes of them?
6. Define Apse-line, Line of Solstices, and Line of Equinoxes. Do these lines constantly point in the same direction? If not, what changes do they undergo?

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The facts of this delightful narrative are drawn chiefly from the diary of Christopher Columbus, which adds an incalculable charm to the story, for we feel that we are reading what actually took place. In spite of all the superstition and ignorance of the age he lived in, to achieve the successful carrying out of his scheme to find the Western World, Columbus was a hero indeed, whose noble character all young people should be conversant with. The story is written in a simple and charming style, and an appendix adds to the value of the book. The binding is superb.

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Imogen and her mother are visitors at the home of an acquaintaince, and by a series of mistakes Imogen imagines a certain Major Rex to be in love with her. A daughter of the house unscrupulously changes the envelopes of two letters, and this complicates matters. The story is a sad revelation of jealousy and revenge in a girl's heart. There are one or two sweet characters in the book.

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The tales of boys and girls herein recorded are all from real life. Over forty examples of heros and heroines, from all ages of the world's history, are here gathered together. Their good deeds and the chief features of their characters are described in simple and telling language, designed specially for the reading of boys and girls of to-day. These noble examples will surely awaken the spirit of emulation in the young.

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A Very Odd Girl; or, Life at the Gabled Farm. By Annie E. Armstrong.

A good sensible girl's story. Vera, the 'Odd Girl,' is half French, and possesses a good many characteristics of that nation. Suddenly introduced into a typical English farmhouse, she feels the life very uncongenial. Her curious outbreaks of lively fun, her faults and mistakes are equally trying to her sober English friends. However, she makes a brave effort to try and improve, and the narrative ends in making her the joy and comfort of the home.

The Two Dorothys. A Tale for Girls. By Mrs. Herbert Martin.

Dorothy, the elder, is an authoress of repute, who adopts her niece 'Dorothy' with a view to direct her studies and cultivate her tastes for a literary career. The training process is at times irksome to the young girl, but proves entirely successful. The glimpses of Dorothy at home and nursing baby Charlie in his sickness are beautiful touches of pathos, and show the true woman in the girl's character. The tale is an excellent one.

The Bushranger's Secret. By Mrs. Henry Clarke, M.A.

A well written story of Bush life. A bank thief, overtaken in the Bush by famine and fatigue, shelters, only to die, in a cowboy's cabin. Before dying he tells where he has hidden the spoil of his robberies. The temptation of great wealth so easy to be obtained is too much for the honesty of one of the party, and he enventually goes off in search of the hidden treasure. The story discloses how he struggles against his conscience, and how greed brings its punishment which awakens him to a sense of his sin. Finally, he restores the money to its lawful owners, and settles down to lead a good, honest life.

The Joyous Story of Toto. By Laura E. Richards.

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Phil and His Father. By Ismay Thorn.

Phil's father, a poor working man, is injured in an explosion at the powder factory where he works. Always having been proud of his strength, the loss of his left arm is a terrible blow to the poor fellow. Good moral results arise from his troubles, and his wounded spirit slowly derives the comforts of Bible teaching. Little Phil takes no small part in the sorrows and triumphs of his father.

An Unexpected Hero. By Elizabeth J. Lysaght.

This entertaining story is supposed to be told by two children. The hero is their cousin Tom. Tom is given to playing practical jokes, one of which resulted in a long illness for his only sister. As a punishment he is sent away to school, and not allowed to come home even for holidays. The sister has an attack of illness during

the Christmas vacation, and Tom's anxiety is so great that he runs away from school on purpose to find out if his sister is likely to recover. Not daring to be seen by his father, he sleeps at the lodge, where, during the night, an alarm of fire is raised, and Tom rushes out and succeeds in rescuing his sister from death, thereby winning his father's forgiveness.

A Rough Road; or, How the Boy Made a Man of Himself. By Mrs. G. Linnæus Banks.

When the birch was considered to be the most approved method of conveying knowledge to the pupil, Robert Wallis was driven from home by its use. In the hands of his father, who happened to be a village schoolmaster, the torture was all the harder to bear. The story gives a detailed account of Robert's wanderings, and of his business capacity and success. His sturdy independence and uprightness does one good to read about, and should inspire any lad to put a stout heart to a steep hill. The tale is remarkably well told, and makes a most desirable book for boys.

Mother Carey's Chicken. By Geo. Manville Fenn.

No Christmas gift will be better appreciated than a copy of the popular 'Mother Carey's Chicken.' We are delighted to see the new and cheaper edition. Our own boys revelled in the pages of this delightful story years ago, and another lot of boys have grown up ready to seize upon this ever-new story with eager delight. Our best wish to young scholars is, may you win a copy of 'Mother Carey's Chicken.'

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DAMPNESS OF WALLS.—Professor Emmerich gives, in the *Münchener Medizinische Wochenschrift*, a simple method of determining the state of dryness of the walls of schoolrooms. It has been found that if the inner mortar does not contain more than one per cent. of water, the building is inhabitable. To determine the amount of water present, Professor Emmerich takes about half a pound of the mortar, crushes it, sifts out the stones, and weighs the sample in a nickel pan. Six such samples are placed in a drying oven kept at the boiling point of water, and exhausted by means of an hydraulic air pump. After about an hour the samples are taken out and again weighed in their state of dessiccation, when the loss of weight indicates the amount of water that has escaped.

VERTICAL WRITING.—Dr. Paul Schubert gives, in the *Zeitschrift für Schulgesundheitspflege*, a report of the progress of vertical writing in Bavaria. It was introduced in 1890 in some of the elementary schools by the Bavarian Government. A committee, appointed by the 'Verein für öffentliche Gesundheitspflege,' was entrusted with the adaptation of the written alphabet to vertical writing. It has aimed at making the letters as simple and flowing as possible, and to retain the least possible difference in the lengths of the long and the small letters consistent with a due regard for established forms. The new letters adopted, together with rules for writing and an illustration of a boy writing in the prescribed attitude, were lithographed and distributed among the children. The lines have to be shorter than in the old system; the height and depth of the long letters above and below the line is fixed at one and a half times the height of the small letters. Dr. Schubert deplores the fact that 'that black enemy of the eyes,' the slate, is still retained for the first few years in the elementary schools, but the abolition of inclined writing and the banishment of squared paper for figures must be regarded as two great hygienic victories.

MONTENEGRO.—The Principality of Montenegro possessed no school whatever in 1850; at the present time there are 75 elementary schools, a college or normal school, and a high school for girls. The latter also serves as a normal school, in which very considerable attention is paid to domestic economy. It is in this school, open to girls of all classes, two-thirds of which are even admitted free, that the daughters of the Prince of Montenegro received all their education. The course lasts six years. Education is compulsory in the Principality; all schools are free for children whose parents cannot pay the school fees. An enlightened visitor to the schools of this small country declares that most of them, even the village schools, will bear comparison with the best establishments of more advanced countries.

—o—

BRITISH MUSEUM 25 NOV 92

ERROR PRIZE.

The three first to point out an error in the November supplement were:—

MR. W. H. TULK, Board School, Keeton's Road, Bermondsey, S.E.

MISS BESSIE HUNT, National School, Berwick St. John, Salisbury.

and

MR. W. T. SCOTT, Welton School, near Lincoln.

As these reached us by the *same post* we have had pleasure in remitting to each a P.O.O for 3s. 6d.

—o—

OWING to the great pressure on our space this month we are compelled to hold over until our next issue the following contributions:—'Well-known Teachers at Work' (Mr. T. B. Ellery), 'Teachers' Drawing Lessons,' 'Occasional Examination Papers,' 'Query Column,' 'Publications Reviewed,' etc.

'CANTATA' COMPETITION.

We regret that we shall not be able to announce the Prize-Winner in this competition till next month. We hope then to publish the music (both notations) as well as the words.

In place of the 'Cantata' we present our readers with a charming original waltz, entitled 'Craiglands,' composed by an accomplished Mus. Doc. of Cambridge—not altogether unknown to our readers—who elects to be known to the world as Rollo Oberstein. May our friends, and enemies too, if we have any, have many a good time during the coming festive season while waltzing to the tuneful strains of 'Craiglands!'

—o—

We very much regret that owing to the continued pressure on our space, we are compelled to hold over the Model Answers to Certificate Questions. To avoid disappointment, however, we shall be happy, upon receipt of a 1d. stamp, for postage, to send to any of our student-readers a set of the Model Answers above referred to. Applicants are particularly requested to state whether they require the papers for males or females, and for the first or second year.—[Ed. P. T.]

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The School Guardian says:—'A new manual of Domestic Economy, the joint work of no fewer than seven different writers, has been recently issued by Mr. Joseph Hughes. It is primarily designed for the use of pupil teachers, students in training colleges, and school-mistresses, but it covers a wider ground than that required of female candidates at the certificate examination, and, moreover, contains so much sensible and useful information of general interest, particularly to housewives, that we hope it may meet with a wide sale.'

The Educational News says:—'It is impossible to peruse such a book without forming higher ideas of every-day life, and without acquiring a better knowledge of how to realise them, than would otherwise be practicable.'

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